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THE ALL-ISLAND AGRICULTURAL SHOW.

We would direct attention to the advertisements that have been issued about this Show, to be held in Colombo in June or July of next year. It is time that people who propose to exhibit began to prepare, to think over what they intend to show, to get seeds, and otherwise get ready for the event.

This is to be a large Show of a kind which has not been held in Ceylon for many years, and of which only the Nuwara Eliya Show, perhaps, gives any idea. Exhibits, therefore, will require to be unusually good to stand much chance of winning prizes.

This is not said to discourage exhibitors of poorer specimens—far from it. Every one should do his best to turn out the very finest thing of the kind that he wishes to exhibit, and if it seem really good and satisfactory, send it in, not say that so-and-so will have much better, and that therefore competition is useless.

Exhibitors should take special care, if they live at a distance from Colombo, to see that their exhibits are suitably packed to prevent any deterioration upon the journey. A little trouble and expense over the packing will be well repaid by the much better appearance of the exhibits when it comes to judging.

The Show cannot be a success without the expenditure of a considerable amount of money, and we would appeal to all, who can afford, to subscribe liberally towards the expenses. Even a rupee helps, and it might be worth the while of the Committee to consider whether a donor of one rupee might not be allowed a certain amount—say 50 cents worth—of free admission.

GUMS, RESINS, SAPS AND EXUDATIONS.

THE PHILIPPINES AND RUBBER.

(From the *Manila Bulletin.*)

Statistics go to show that the United States purchased from abroad in 1910 about $106,860,000 worth of raw rubber, more indeed than the aggregate used by any two countries in the world. Of this amount the Philippines are not credited with producing any part, the supply being secured from the Congo, South America and Malaysia. The United States went outside her own territory to purchase, while hundreds of thousands of acres of rubber lands in the Philippines are lying idle.

It would appear that the American manufacturers not only prefer purchasing their supply from foreign countries, but are willing to pay the export duty added by the rubber-producing countries, while Philippine rubber could be secured without this addition to first cost. Every rubber-producing country collects an export tax on the product except the Philippine Islands.

If there be any doubt as to the quality of Philippine grown rubber, there is plenty of evidence to prove that no better product is grown anywhere in the world.

The report of an expert in Hamburg on a small shipment of rubber grown by the Basilan Plantation Company, and forwarded by Messrs. Behn Meyer & Co., under date of January 11, 1911, says :—

"The sheets were thin, medium coloured, transparent and of very good quality. It has good nerve, and is well prepared. Such rubber will always find a good sale here.

"The price of fine hard Brazilian para is five shillings two pence per pound to-day, and I appraise this Philippine rubber at 11·50 marks to 11·70 marks per kilo."

So much for quality. The Basilan plantation is near Isabela, Moro province, and is the most advanced of all rubber plantations in the Philpines. Two shipments have already been made, and the quantity will increase as the trees mature.

Japanese capitalists have been purchasing large tracts of land in Malaysia, and the Japanese manufacturer is making headway in putting the finished product on the market. The representative of the Goodyear Company complimented the Japanese last year on their splendid exhibit of rubber goods at the exposition at Kobe. Why have the Japanese passed up the Philippines and taken up land in Malaysia, and why are we so ignored by the American manufacturer and capitalist who are also becoming interested in Malaysia rubber lands ?

There is something wrong somewhere. We have the soil, the climate and the labour. We have no export duty and the quality of rubber is as good as any prodnced, but we remain non-producers.

It is not improbable that we have not given the widest publicity to the advantages offered by the Philippines to the prospective rubber grower. That we should be ignored were the truth about the islands made known generally in commercial centres in the United States and Europe, we do not believe. That the United States should spend $106,860,000 abroad for a product, the whole of which can be supplied from American territory seems very improbable, nevertheless it is true.

We believe this subject should be given special attention by the Merchants' Association. Rubber Manufacturers in the United States and Europe, capitalists interested in the growing and manufacture of rubber should be furnished with all the data available in some attractive form. We must spread our rubber gospel where it will do the most good. A competent publicity man should be put on the job and sent among the Philippines to preach Philippine rubber. Our slogan in the United States should be "We need that $106,860,000 rubber money to swell our annual receipts, and we will not be happy until we get it."

BRITISH GUIANA AND INDIA-RUBBER.

BY THE EDITOR OF "THE INDIA RUBBER WORLD."

(From the *India Rubber World*, Vol. XLIV., No. 4, July 1, 1911.)

SECOND LETTER.

Again the Climate.—A Boston Boy Planter.—The Bete Rouge.—Getting acquainted with the Sapium Jenman's Description of the Tree.—Sapium Plantations.—The Macwarrieballi.—Brittle Balata.—Balata back in 1883.—Notes on Balata Gathering.—Some Balata Statistics.

Speaking again of the climate of British Guiana, I want to affirm that of all the tropical countries I have visited

it comes nearest to being my ideal. Not in Georgetown nor on the coast. It is a trifle too sticky there, but healthy withal. But 40 or 50 miles inland it is just what one who love tropical warmth in midday and cool nights would desire.

I met a young American in Georgetown on the occasion of my last visit who is well known to many in the rubber trade. He it was who once crossed the Andes and came down over the falls of the Madeira with a lot of rubber for the Safety Insulated Wire and Cable Co. He had become a resident of British Guiana, having purchased an island not far from Georgetown, and was engaged in planting *Hevea*. He was tapping wild *Sapiums* that he found on his land, shipping the rubber in and getting a very good price for it. His backers were a couple of rubber manufacturers in the United States, who, although not big factors, were enterprising enough to wish to be sure of their own source of supply. The young American was living in a little cabin that he had erected on the island and hiring a few men, and for the amount of money that he had to spend doing a lot of work. His seed supply he secured in a very shrewd way. Most of the planters have to send to the Far East, and there are lots of "failures to germinate" in the seed. This youngster found in Trinidad a small estate with a few old *Heveas* on it. He induced a friend to buy it, and the trees furnish all of the seed he can comfortably take care of.

He was in excellent health with the exception of "hives," as he explained. Visitors to the Guianas and Brazil, if they stray outside of the cities, are apt to suffer from mild attacks of "hives." At least that is what they confide to some friend after a period of energetic and unavailing scratching. The fact is, they have annexed a small red bug, the *bete rouge*, that burrows beneath the skin and is troublesome if not eliminated. Alcohol will do it, one or two applications being sufficient usually. As a preventive many soap their legs and come off scot free. And others, particularly those who are used to tropical pests, pay no attention at all to them. I collected some in all of the places that I visited, but it was in British Guiana that I got the liveliest specimens. They settle behind the knees and about the waist and are energetic at nightfall. I was out of alcohol, and so I used a liniment that one of the planters had in stock. It killed the parasites promptly, but it didn't stop there. It searched me through and through, penetrating, burning until it finally exhausted itself, except for the smell it left behind. It was fine, one felt so warm and comfortable when the ache stopped. I was therefore able as an expert on tropical itches to diagnose my friend's ailment and prescribe a remedy, not the liniment, however.

Speaking of trees indigenous to British Guiana, that is, rubber trees, the *Sapium Jenmani*, called by the natives Touckpong, seems the most valuable. I had often wondered why Professor Harrison and the very alert and scholarly Assistant Director of Science and Agriculture, F. A. Stockdale, paid so much attention to it. Nor was I enlightened when I saw the specimen planted by Jenman on the Botanical Gardens. It looked so scraggy and sickly and was such a pitiful object. But when I saw a wild specimen, in soil adapted for it, a fine straight forest tree at least three feet in diameter, I began a revision of my prior prejudices. Then, too, it develops that it is one of those trees that can be tapped far up on the trunk, and the latex coagulates on the tree forming a very high-grade scrap. The department had some of the rubber valued some three years ago, and the price put upon it was \$1·07 and plantation at \$1·16, The Imperial Institute analyzed the samples and they contained 93·7 per cent. of rubber with a resin content of only 1·8 per cent. In 1909-10 the colony shipped 6,369 pounds of rubber, most of which was in scrap form, and doubtless *Sapium* rubber. It was not all carefully collected, however, and it brought about \$3,250.

Jenman it was, who back in 1883, first really brought the rubber to the attention of the world. He journeyed far into the forest, found the trees which at first he thought belonged to the *Ficus* family. What he wrote of it is most interesting. In part it is as follows:—

"The trees were large individuals, four or five feet in diameter of trunk, and 120 or more feet high. Their trunks were long, straight and unbranched for 60 or 70 feet from the ground. The lowest six feet of one had been scarred, and from the scars the milk had run and was dried in tears or strings several inches long on the bark. Most of the congealed rubber was, however, contained in the fissures made by the cutlass cuts, from which places it was rather hard to extract it, because of the tenacity with which it held to the inner bark from which it had oozed. I gathered and made a ball, following the Indian plan of winding it up like twine of what was on the trunk. They score

the trunk and then leave it, the milk oozes from the wounds, trickles down the bark and coagulates and becomes dry in a few days. My guide said it took three days to dry, but I should have supposed a shorter time might accomplish the change, the little rivulets are so very thin. That which was in the old cuts—cuts probably a year or more old—had turned black, but that in those recently made was nearly milk-white. The Indian boys, who are perhaps accustomed to play with the balls, as I noticed from several which they brought me, never make them large, they strip the dry-strings very dexterously from the bark, taking good care to extract the larger portion to which I have alluded as partly concealed in the incisions, and stretching it with a good deal of tension, wind it up. These balls have wonderful elasticity and bound with very little impulsion several feet of the ground. The rubber, too, seems exceedingly tenacious and strong. . . . This method of gathering is very economical of time, for it saves the tedious operation of catching the milk in a vessel as it issues from the wound, which is the most bothersome of all the operations. The principal objection to it is, that the rubber becomes soiled by the dirt adhering to the bark, a little of which it retains, and no doubt this would deteriorate its market value ; but this depreciation might be reduced to a minimum by carefully brushing the surface down prior to commencing collecting operations. Rubber, which has foreign matter incorporated with it, is classed under the term negrohead in the market, though its value depends on the measure of its freedom from dirt or other substance having regard, of course, to the quality of the rubber itself when clean. . . . . I regard the discovery of this tree of great interest and probable importance, attaining, as it does, such a vast size and producing a material of apparently excellent quality. The Indians know it under two names, the *Carabasi* calling it Touckpong, and the *Arawacks* Cumakaballi. Noble in all its proportions, spreading and lifting its massive head above its neighbour's, it is one of the largest trees of the forest, and has a wide and general distribution over the deep belt of low country in the colony."

In 1905 considerable plantations of the *Sapium Jenmani* had been established in the north-west district of British Guiana, and there is no reason why they should not be successful. As a rule, the planting of this species has been encouraged when the trees are found wild, and where they appear to thrive the best. The planters are also thus able to secure a good seed supply close at hand. Numbers of plantations are to be found in the country of Berbice, on the Demerara river, on the lower reaches of the Essequibo river. The Government is also carrying on experiments in tapping on its forest reserve at the mouth of Bonasika Creek that will soon tell the whole story of the yield by a variety of methods. In addition to this at all of its experiment stations, in the northwest district at Issororo, at Onderneeming, Christianberg and Pomeroon, the Government has been planting *Sapium*, and carefully tabulating every fact regarding its growth, etc.

Very little interest seems to be taken in *Castilloa* in the colony. A few plantations have scattering trees, and they are to be found in the Botanic Gardens, of course. But, as for any extensive planting or any likelihood of it, that is a vain hope. The planters are not in favour of it, and the Government experts do not advise it.

Speaking again of that indefatigable traveller, the late G. S. Jenman, he believed that in the *Forsteronia gracilis*, which he found in abundance, he had discovered another valuable source of rubber.. He was camping far upon the Demerara river at Malili, some 200 miles from Georgetown when, in one of his forest excursions, he cut deep into a festoon of bush rope, and was surprised at the quantity of latex that gushed out. He cut down forest giants to get at the whole vine, spent days in collecting latex and in trying to coagulate it, and finally sent rubber, flowers, leaves, etc., to Kew for identification and valuing. His report, which covers pages, is full of enthusiasm and interest. The Indians called the vine *Macwarrieballi*, and the botanists at Kew said it was *Forsteronia gracilis*. The experts at Silver-town, to whom the rubber was submitted, said it was too sticky and soft to be valuable. That, however, was in 1888, when they would have turned down guayule, for example, and many other lesser rubbers, as indeed, would any rubber manufacturer of that period. Perhaps, therefore, it may yet appear on the market.

Speaking of the lesser rubbers, and before beginning on the balata of which the colony ships large quantities, I want to refer again to what is commonly known as brittle balata from the *Humiria floribunda*. If it is as abundant as some think, and can be cheaply gathered, it should have a place. A British Guianian sent me a sample shortly after my first visit to the colony.

He had an exaggerated idea of its value, however. The samples are before me as I write. They are plastic, brownish in colour, and very dense, and show but little elasticity. They look very much like a low-grade gutta. I so wrote him, and his reply is certainly optimistic. I append it as it has a certain value.

"Your letter of recent date received to-day, and I most certainly do not agree with your deductions. Brittle balata, or as it is sometimes called bastard balata, is altogether different from the recognized balata of commerce. Brittle balata is, in my long and experienced opinion, a caoutchouc, whereas the balata of commerce is a gum. My samples are from the milk or latex of caoutchouc trees which grow in enormous numbers throughout the whole of tropical and subtropical America, hence the rubbers from them can be regularly shipped in enormous quantities.

"I send you five samples made from caoutchoucs selected from our forest trees by very experienced bleeders. These five samples are the same as sent to Europe, and which have been well received, and have been valued at prices that will, I think, satifactorily recoup us.

"I believe we have an assured trade with both England and Germany, and perhaps also with Denmark, so I cannot see how we should fail with America, as your letter so manifestly indicates.

"As before stated, these caoutchoucs can be easily obtained from trees that are enormously abundant, so that the rubbers from them should naturally be supplied at a lower price than the generality of such articles are. Therefore, we can ship to America if only the prices will allow us, and if only we can find trustworthy people to ship to, because it is we alone who are shipping, and it is we alone who are to be afterwards paid for articles that only the market requires, therefore we wish to know the present approximate market price of the samples sent you.

"Although the enclosed samples are small, they are quite large enough for any real expert or for any capable manufacturer to judge by.

"As soon as our new factory is started, we hope to turn out a very large supply and later on we may have to establish branches in Trinidad, Brazil and Venezuela."

Back in 1883 and again in 1885 Jenman sent in a voluminous report concerning the "gutta" trees in the colony. It was characterised by the direct style that all his communications show, and in pite of the fact that it was published as a dignified Government utterance, is fascinating reading. He briefly sketches the Indians and the bush negros, and an enthusiastic botanist, recognized and noted hundreds of tropical trees, vines and plants, as he journeyed into the forest in his search for the "bully" tree. Bits of tropical experience crop up, as for example, the presence on the Savannahs of *weree-weree* fly that just as soon as the perspiration starts swarm over the face and creep into the eyes. The engineers on the Madeira-Mamore Railway know all about them, and it may comfort them to know that Jenman, twenty-six years ago, spoke of them only as a trifling annoyance, as he did also of the Cabowroo (known in Central America as the Rodador). His examination of the balata bark was very thorough and so understandable that it is worth quoting verbatim.

"If a piece of partly dry bark be examined it presents (without going out into the details of structure) three primary layers. The outer layer is dark brown, hard and dry; the next, which is usually much thicker, is rather spongy in tissue and lactiferous and of a reddish raw beef colour; the inner one is thin, more ligneous, a brown wood colour and with fewer lactiferous vessels. The outer layer is subdivided into several very thin layers. They are of two kinds, and differ much in the density of their cells. They alternate a dark brown and pale gray. In young trees there are few, but they increase with age. I have counted as many as twelve of each kind in the bark of a large tree. The second primary layer is that which yields the balata milk, though the inner, more ligneous layer is not devoid of it. These two layers are homogeneous and adherent to the wood until it is dry. The longitudinal fissures, which I have mentioned as a prominent external characteristic of the bark, are not absolute divisions of the cortical tissue (or at least they only become so eventually as the layers peel off), for where they occur the outer layer dips into the thick lactiferous layer and so preserves its continuity. The thin layers of the external primary layer crack transversely in pieces an inch or two long, and by lateral contraction eventually scale off."

He had received a long letter from Sir Everard im Thurn, who had penetrated to many remote places in the colony, in which it was stated that many of the balata gatherers cut the tree down to extract the milk. Jenman, as servant of the Government, was anxious to protect the property of the Crown, and hunted industriously for such

violators of the laws, but apparently found none. The use of the wood of the tree for sugar rolls in the West Indian islands, and for arms and shafts for windmills in the Guianas is also noted by him. The trees were found to vary considerably in the amount of milk they give. The collector would make a single cut in a tree, watch the flow for a few minutes, and if it was not satisfactory go at once to another tree, claiming that it was a "male" tree and no good. As an adulterant the collectors then and now often add the latex of the *Sapium Jenmani*, if it happens to be plentiful in the vicinity of their camps. The methods of tapping, coagulating and handling are exactly the same as those already described in the story of balata in Dutch Guiana (see the *India Rubber World*, March 1, 1911).

According to Professor Harrison and Mr. Stockdale, British Guiana sent out its first balata in 1859, but rubber manufacturers would have none of it. In 1862, however, another effort brought it to the favourable attention of several British manufacturers, and a market was created. Three years later 20,000 pounds were exported. Then the demand fell off for about ten years, when it revived. During 1908-9 1,090,405 pounds were produced, valued at nearly one-half a million dollars. 1910-11 will probably see an increase both in product and value. By the way, as a lesson in modest taxation on exports, balata is taxed two cents a pound, and that in spite of its nearness to northern Brazil. The price of balata has varied exceedingly. In 1883 some parcels of it sold as low as 12 cents a pound, and for years it brought only 30 to 35 cents. Jenman adds that a company in Boston, Massachusetts, offered in 1883 to pay 50 cents a pound for it, if they could be assured a large and constant supply.

The British Guiana statistics on balata are very informing, and surprisingly complete. Among other things they note that in 1904-5 the United States took but 9 per cent. of the balata crop; in 1908-9, however, it took 25 per cent.

(*To be continued.*)

THE OUTLOOK FOR RUBBER.

(From the *Indian Agriculturist*, Vol. XXXVI., No. 3, March 1, 1911.)

No one who has followed the course of the rubber market will be disposed to contest the dictum of one of the leading trade authorities at Home that the year 1910 was the most remarkable year in the history of the industry since the discovery of vulcanisation. During the month of April the price of Hard Fine Para reached the unprecedented figure of 12*s*. 6*d*. per lb., and about the same time plantation rubber was sold at 12*s*. 10*d*. per lb. There has been a great reduction in the quotations since these prices were realised, but although rubber is selling at less than half what is fetched during the boom of last year, there appears to be no cause for apprehension as to the future of the plantation industry. The position in 1910 was for a considerable period altogether abnormal. Owing to the prices ruling the consumption of the product by manufacturers was to some extent checked, but the return to normal conditions has created a more healthy trade position, and manufacturers are able to secure their requirements in a satisfactory way. The principal bugbear of the shareholder in plantation companies is the possibility of over-production. The leading trade authorities, however, do not seem to attach much importance to this point. For years past the demand for rubber has rapidly grown, and with the extension of motor traction which is everywhere visible, the increase must continue. The production of manufactured rubber goods in the United States in 1890 was valued at £8¼ millions, while fifteen years later the census returns placed the total at nearly £30 millions, and there must have been a great increase since the later year owing to the development of the motor car industry. Another interesting comparison is afforded by the statement that the imports of raw rubber and allied materials into America rose from 32 millions lbs. in 1888-9 to 179 million lbs. in 1909-10. There are no figures available relating to the manufactures of rubber in the United Kingdom, but the increase there, as well as in continental countries, has undoubtedly been on a prodigious scale. The contribution of plantation rubber to the world's harvest still constitutes a small proportion of the total. Most of the product brought to market emanates from the forests of Brazil. The receipts of wild rubber at Para in the season 1909-10 amounted to over 39 thousand tons, which is more than five times the total exports of Malaya and Ceylon combined during last year. There has been an enormous increase in the quantity of wild rubber obtained from the forests of the Amazon basin in recent years, the total having grown from 26 thousand tons in 1899-00 to 39 thousand tons last season. The potentialities of wild rubber suggested by these figures at first sight appear formidable from the point of view of the investor in plantation companies. But

the dominating factor in the problem is necessarily the cost of bringing the rubber to market, and here the plantation industry stands at a decided advantage. A Foreign Office report which was recently issued state that probably only a fraction of the Para Rubber in the Amazon region has been exploited. But it goes on to remark that the better the conditions are for wild rubber the worse they are for human habitation, and that so dense are the forests and so damp the climate that large plantations of rubber trees are being made in Brazil in regions easier of access. There has been considerable dispute as to the cost of bringing Para rubber to market. Three shillings per lb. is the figure that has often been mentioned, and 2*s*. 6*d*. per lb. may apparently be taken as the minimum. On the other hand, plantation companies which are well managed and favourably situated can market their produce at something like a shilling per lb., so that they could secure substantial profits if prices fell to a point at which the collection of wild rubber would become unremunerative. It is, of course, possible that owing to the constantly increasing areas which are being planted there may come a time when production will outstrip consumption. But in considering this possibility it must be borne in mind that with a large increase in the world's harvest and a fall in prices to a much lower figure than now obtains, rubber would be used for purposes which are now served by inferior materials. Another consideration for the shareholder is the possibility of the discovery of a process for producing synthetic rubber on a commercial basis. There does not, however, seem to be any prospect of such a result being attained. A German chemist has succeeded in obtaining what are described as infinitesimal quantities of rubber in the laboratory, but a trade journal which has been investigating the question declares that the discovery will have no more influence on the price of rubber than the artificial diamonds of Moissan have had upon the price of natural stones. A rubber substitute has also been made by the Bayer process. Here again, however, enquiries have elicited the fact that the process is simply in the position of a laboratory experiment. In any event it is obvious that if the price of the natural product were reduced to a comparatively low figure, there would be less inducement to chemists to continue the attempts which have been made for years past to produce synthetic rubber.

FIBRES.

PAPER-PULP TESTING AT THE FORESTRY COURT CELLULOSE LABORATORY, ALLAHABAD EXHIBITION.

Part II. Woods.

By W. Raitt.

Much of the practice of the art of dyeing is founded on the fact that cellulose, whether as paper, or in the form of a woven fabric as calico or linen, has a great affinity for certain groups of colour compounds, precipitating them upon itself or filtering them out of their solutions. One of the objects of the pulp maker, in the earlier stages of the manufacture, is to prevent this occurring, otherwise an unbleachable pulp may be the result. The soda process does, in the case of some materials, produce dark coloured compounds during digestion which fix themselves on the pulp, degrading it to a partially or wholly unbleachable condition. *Salix tetrasperma* and, in a lesser degree, *Trewia nudiflora* proved to be marked examples of this, and in general, the difficulty with most of these low country woods appeared to be that of either preventing the formation of such colours or of producing them in a permanently soluble form, capable of being completely washed out of the pulp.

A sample of unbleachable *Salix tetrasperma* soda pulp, repeatedly washed with hot water until the wash water flowed away perfectly clear and bright, was steeped for fifteen minutes in a weak (two per cent.) hot solution of sodium sulphide. The result was a dark brown liquid nearly as dark as the original soda liquor from the digester, the colouration of which remained soluble and was easily washed out of the pulp, leaving the latter several shades lighter in colour and easily bleachable, in other words, the sodium sulphide had reduced the precipitated colours to a permanently soluble condition.

Now the distinguishing feature of the sulphate process is that it combines the reducing action of sodium sulphide with the oxydizing and hydrolysing action of sodium hydrate (caustic soda), and, as

the above experiment showed that the objectionable colours were reducible, the sulphate method of digestion seemed to be clearly indicated. Before deciding to follow it up it was necessary to give some consideration to the rival method of digestion by the *sulphite* process, which does its work by sulphur dioxide, partly in solution and partly in combination with lime as calcium bisulphite. It does undoubtedly give good results with *coniferous* pulps, not only in quality and colour of product but in economy also, though the latter is less in comparison with sulphate than with soda; but it is doubtful whether it would give equally good results, so far as colour is concerned, with the class of woods now under consideration. In the case of bamboo, which presents a colour difficulty similar to the one we are now dealing with (both, it will be noted, being low country, tropical products), the results have not been quite satisfactory, as attested by the experiments of Richmond (American Bureau of Science, Manila), Coventry (Forest Institute, Dehra Dun), and ourselves. Then it is doubtful whether the sulphite process is practicable in a tropical country without the aid of a system of refrigeration which would seriously discount its economy. Its success depends mainly on the absorption by water or lime water, of sulphur dioxide gas, an operation which is considerably handicapped by any increase in the temperatures of both water and atmosphere over those normal in temperate latitudes. On the whole, the balance inclined in favour of sulphate, so it was resolved to follow this up, leaving sulphite to be enquired into on a future occasion.

The success of sulphate digestion depends largely on obtaining the proper balance or proportion between the two chief constituents of the liquor, and a series of preliminary trials were necessary to arrive at this. It may vary considerably for different classes of material. Ultimately a proportion of 6 of hydrate to $2\frac{1}{2}$ of sulphide appeared to give the best results with these woods. For want of time, no attempt was made to fix the minimum *quantities* necessary. These would certainly vary in each case and will have to be subsequently determined. The present object was to solve the colour problem of a whole *class* of woods showing similar characteristics as regards colour, and which could apparently be dealt with by liquor containing hydrate and sulphide in the above properties. The quantities required will probably differ with each individual of the class, but the proportions not; so all that was necessary was to secure a standard liquor of sufficient density to ensure reduction of the most difficult of the species selected for trial. After the *class* problem has been solved, it will be comparatively easy to work downwards from the maximum density in order to settle the requirements of each individual.

From the pulps scheduled as second class in quality, a selection had to be made of those which best combined the commercial requirements of quality of product with abundance and cheapness of raw material. Having regard mainly to the Tarai districts of the united Provinces, Mr. Clutterbuck selected *Bombax malabaricum*, *Salix tetrasperma* and *Trewia nudiflora* as those best fulfilling the latter considerations. The selection is a fortunate one from the other point of view, for these also happen to be among the best of their section in quality and yield. The coniferous pulps, scheduled as first class, were for the present set aside, as it is already known that they behave well under sulphate treatment.

These three were first submitted to analysis, after being reduced to an air-dry condition, with the following results :—

	Bombax malabaricum. Per cent.	Salix tetrasperma. Per cent.	Trewia nudiflora. Per cent.
Hygroscopic moisture	9.26	11·38	12·7
The following on the dry sample :—			
(*a*) Water extract tannin, gum, mucilages	5·10	4·75	4·00
(*b*) Alcohol and benzine extract Rosin, oil, wax	2·90	2·90	3·00
(*c*) Hydrolysis by treatment for one hour in 1 per cent. boiling sodium hydrate	13·30	8·00	8·50
(*d*) Ash	2·60	1·00	2·30
(*e*) Cellulose	49·00	53·20	52·00
(*f*) Lignin, by difference	27·10	30·15	30·20
	100·00	100·00	100·00
Total to be removed by chemical action, viz., (*b*), (*c*), (*d*) and (*f*)	45·90	42·05	44·00

The loss by hydrolysis (*c*) was determined after exhaustion by (*a*) and (*b*), and may be taken to cover pectous matter and the weaker forms of cellulose which, under any method of treatment, would be lost by being hydrolysed into soluble matter. The larger amount of this in Bombax, coupled with the smaller quantity of lignin, would indicate that this wood can probably be successfully treated with weaker liquor than the other two.

A sulphate liquor was now prepared containing hydrate and sulphide in the previously mentioned proportions and also small quantities of carbonate, sulphite and sulphate of soda in the proportions usually found in factory liquor prepared by aid of a recovery plant. This was done in order to work as closely as possible to factory conditions. The two first, however, are insufficient in amount to have any appreciable effect on the operation, while the sulphate remains quite inert. The total strength of the liquor expressed as alkali ($Na_2 O$) was 7·4 per cent., which would include all but the sulphate. The density 19° by Twaddles' hydrometer, and sufficient liquor was used to just cover the material after it had been well tamped down in the digester. Although the same liquor was used for each of the three, the minor points of duration, temperature and pressure were varied in each case in accordance with their behaviour as observed in preliminary trials. The details of digestion, together with a bleaching comparison of soda process results, and the microscopic examination, are as follows:—

	Bombax malabaricum.	Salix tetrasperma.	Trewia nudiflora.
(*a*) Quantity of liquor per kilo of wood...	3,000 cc.	2,500 cc.	2,500 cc.
(*b*) Duration, temperature and pressure above atmosphere	4 hrs. 120 lbs. 176° c.	3 hrs. 140 lbs. 183° c. followed by 4 hrs. 100 lbs. 150° c.	2 hrs. 140 lbs. 183° c. followed by 5 hrs. 80 lbs. 162° c.
(*c*) Yield of unbleached air dry pulp ...	37·4 %	40·1 %	41·3 %
(*d*) Quantity of bleaching powder of 35% strength percentage on weight of the unbleached pulp	14 %	18 %	13 %
(*e*) Colour obtained	Good white	Cream white	Good white
(*f*) Quantity of bleaching powder required to produce a similar colour after soda treatment	24 %	Unbleachable	22 %
(*g*) Microscopic examination :—Average length of ultimate fibre ...	2 m/m.	1·6 m/m.	1·8 m/m.
Average diameter of ultimate fibre ...	03 m/m.	025 m/m.	03 m/m.
(*h*) Average weight of wood per cubic foot	23 lbs.	31 lbs.	28 lbs.
(*i*) Quantity required for one ton of pulp in cubic feet	260	180	194

In each case the resolution of the wood was complete and the pulp entirely free from chips or undigested particles. It was evident in the case of *Trewia* that the treatment was somewhat in excess of that necessary and probably as good results would be obtained by digestion at lower temperature. In the case of *Bombax* it was considerably in excess, with some loss of yields, in spite of both duration and temperature being less than in the other case. We may therefore expect that further experiment will show it can be reduced with weaker liquor with an improvement in the yield.

The remarks as to bleached colour have the following significance :—

Good white.—Suitable for fine printing paper and common writings.

Cream white.—Suitable for common printing and newspaper. In regard to strength and quality generally, I would place these pulps as follows: Taking spruce pulp as the type of European and American first class pulps, and poplar pulp as the type of those of the second class, then *Bombax* comes out slightly superior to poplar, and the other two equal to it. The average length of the ultimate fibre in all cases exceeds that usually found in deciduous trees, and in the case of *Bombax* approaches that of the *Coniferæ*. The claim of the sulphate method to produce a stronger and tougher as well as a better bleaching pulp, is fully borne out by a comparison with the results obtained by soda treatment, and the most interesting feature

of these tests is the evidence they afford of success of the combined hydrate and sulphide treatment in dealing with the colour difficulty.

This enquiry has not as yet proceeded far enough to enable anything like close estimates of the cost of such pulps to be framed. In particular, information as to transport of raw material from forest to factory, and cost of fuel at factory is lacking and cannot be supplied until suitable manufacturing sites are suggested, and their advantages in respect of water or rail transport, for both raw materials and product, examined; so that it would seem preferable at the present stage to estimate the margin available for the unknown expenditures rather than attempt close estimates of the total nett cost,

The value of such pulps at the points of consumption—the paper mills—may be taken at Rs.120 per ton. If we reserve Rs.10 of this for profit—which, on an output of 150 tons per week and a capital of Rs.6,00,000, would be equivalent to 12½ per cent. per annum—there remains Rs.110 to cover all manufacturing charges, and transport of raw material and product.

Taking the Government royalty on standing timber at one anna per cubic foot of square timber measurement, which is about 78 per cent. of the whole tree, the cost to the pulp maker, who uses the whole and does not waste the slabs, amounts to 9·36 pies per cubic foot. On *Salix tetrasperma*, therefore, this item would cost Rs.8-12-0 per ton of pulp. Assuming that the cost of coal does not exceed Rs.10 per ton, and that the manufacture is carried out on the sulphate system with the aid of a recovery plant, the manufacturing costs and charges, including repairs and depreciation of plant, wages and superintendence, and the royalty on wood, should not exceed Rs.75 per ton of product. We thus obtain a margin of Rs. 35 per ton of pulp to cover transport of one ton of pulp to market and the extraction of 2½ tons of raw material from forest to factory. If we assume that Rs.15 of this will be absorbed by freight of pulp to market, there remains Rs.20 for charges on 2½ tons of wood. It does not appear to be very liberal allowance, but the aggregate per annum, Rs. 1,50,000, is large enough to warrant the consideration of light forest tramways in situations where water transport is not available. In the absence of full data the figures are not put forward as being anything more than approximate, and they are estimated on the most costly, as to chemical treatment, of the three species dealt with. It is probable that the margins in the cases of the other two will be larger. For the present, the margin arrived at may serve as a guide to the selection of manufacturing sites.

The pulps made from the Himalayan *Coniferæ* proved to be in all cases equal in quality and yield to those now so largely manufactured from their European and American congeners, and in two cases, at least, were distinctly superior in strength and bleaching qualities. Such pulp would be worth to the paper-mills Rs,7-8 to Rs.10 more per ton than those dealt with above, and the margins available for transport would be correspondingly larger. The spruce, on account of its good natural colour and great length of fibre, is admirably adapted to the manufacture of the non-chemical form of pulp known as "ground" or "mechanical" wood-pulp, an indigenous source of which is badly wanted to enable our paper-mills to compete with the cheaper classes of imported papers. Where water power is available, in conjunction with spruce areas, this branch of the industry is well worth extending and close enquiry.

In the next and concluding article, grasses and grass-pulps will be dealt with, and the tabulated results of the whole enquiry given.

EDIBLE PRODUCTS.

COMMERCE IN PHILIPPINE TOBACCO:

AND ITS MANUFACTURE DURING THE CALENDAR YEAR 1910.

(From the *Manila Bulletin*, August 13, 1911.)

The Summary of Commerce for the Philippines for 1910 has been issued by the War Department. In regard to tobacco the report says as follows :—

"Under tobacco and its manufactures a value of $198,978 is shown as imported from the United States. This was to a large extent plug and smoking tobacco, which the collector of internal revenue states is almost wholly for the consumption of the army and navy, but another item to the value of $49,040 was credited to leaf tobacco. The inadequacy of Philippine wrapper to meet the needs of the cigar industry has been frequently referred to, and

during the period of heavily increased cigar production to meet the large consignments to the United States following free trade legislation there developed a monthly trade in American leaf of some importance. This, however, was not maintained, but practically disappeared with the material shrinkage in cigar exports to the United States, and only $22 worth figured in the latter half of the year.

"Greatly increased activity in the cigar manufacturing industry for the export trade was a feature of the year, chiefly in consequence of the free entry of its products to the American market, though substantially large quantities were also shipped to other countries. Total exports increased from 151,457,000 in 1909 to 184,407,000 in 1910, of which quantity in the latter year one-third found an American market, the free trade benefit to the cigar industry being shown by a total export value of $2,759,661 as compared with an annual trade of about a million dollars in years prior to that legislation. Though exports to the United States make a satisfactory showing for the year as a whole, reference to the trade by months shows that while an average of eight million per month was maintained during the first half of the year, in the latter half there was a monthly average of but two million. This comparatively low monthly average was the result of active measures that were adopted to restrict the proportion of low grade exports and prevent over-stocking the market through speculative consignments.

"The following table includes conditions prior to the legislation of August 5, 1909, as well as shipments made in anticipation, and summarizes by quarters the export movement as affected by free trade:—

Quarter.	Exported to United States.	Exported to Other countries.	Total.
	Thous.	*Thous.*	*Thous.*
Jan.-Mar., 1909	422	28,152	28,575
April-June ...	1,711	31,204	32,915
July-Sept. ...	9,913	29,174	39,087
Oct.-Dec. ...	25,030	25,850	50,880
Cal. year,'09	37,076	141,381	151,457
Jan.-Mar.,1910	26,587	23,885	50,472
April-June ...	22,401	33,352	55,753
July-Sept. ...	7,096	32,804	39,900
Oct.-Dec. ...	5,442	32,840	38,282
Cal. year,'10	61,526	122,881	184,407

"Exports of leaf tobacco amounted to 21,926,744 pounds, valued at $1,593,342. There was an increase of about a million pounds over the small trade of 1909, while the average price 7·3 cents was about the same. Spain was the leading purchaser, and with Austria-Hungary took the chief portion as in previous years. Only 7,436 pounds were exported to the United States under the free-entry privilege that provided for 1,300,000 pounds annually, and such improvement in price as accrued to the tobacco producer from free trade was indirectly through the increased local demand in the cigar industry."

Another table accompanying the report gives the exports of tobacco, cigars and cigarettes by countries for 1908, 1909 and 1910. In 1908 the United States took $18,376 worth of cigars; in 1909, $737,396, and in 1910, $1,560,799, showing the tremendous growth of the business following the Payne tariff provision.

RICE CULTIVATION.

(From the *Journal of the Board of Agriculture of British Ggiana*, Vol. III., April, 1910. No. 4.)

During the past few years a very considerable rice industry has arisen in the colony, and in many districts very satisfactory returns have been obtained. In 1908, some 38,000 acres were returned as being under rice, which gave an average yield of 25 bags of paddy to the acre, while in 1909, 36,000 acres were cultivated in this crop and the returns were somewhat lower. The unsatisfactory season to a certain extent may have been responsible for some of the smaller yields, but lack of proper attention to such vital questions as selection of seed for planting, careful preparation of the land, and choosing the proper season of the year for planting have without doubt tended to bring about the lessened returns. With a view to assisting cultivators of rice, the following short article has been prepared for the Rice Cultivation Committee of the Board of Agriculture by the Director, Science and Agriculture, and the Government Botanist, and if the instructions there given are closely followed, satisfactory results should be obtained.

PREPARATION OF THE BEDS.

Land to be put into rice should be laid out in beds with dams 2 to 3 feet wide and 2 feet high between them. The beds should be carefully levelled and arrangements made for their drainage and irrigation. The

most satisfactory arrangement we have found in our experience is one, whereby the irrigation trench runs across the 'tops' of the beds immediately outside the head dam, through which small wooden 'kokers' are placed in order that water can be admitted to any bed independently of the others. The beds are made to slope sufficiently with a shallow drain down the middle of each, so that the drainage is accomplished at the ends of the beds away from the irrigation trench. This system of irrigation and drainage has worked satisfactorily on the rice fields at the Botanic Gardens, and these fields should be visited by all who contemplate improvements in their rice cultivation in this direction.

In throwing up the dams between the beds, care must be taken to remove as little as possible of the surface soil from the beds, or otherwise, if soil is taken off too deeply, a heavy, frequently alkaline subsoil is reached, which will only give small yields. Poor yields are often the result of taking off too deep a layer of soil for making up unnecessarily high dams. The security of the dams must be carefully attended to, for proper attention to the dams is one of the most important duties of the rice cultivator.

CULTIVATION.

The best land for rice is clay-loam with an almost impervious subsoil. It should be carefully forked or ploughed four to five weeks before the crop is to be planted. This forking or ploughing should not be deeper than about 6 inches, or otherwise the sub-soil may be turned to the surface, and the yields reduced. The depth to which land may be forked or ploughed varies with the locality, and experience soon indicates the correct depth to adopt. The first part of the land to be cultivated should, however, be the nursery. This should be carefully chosen and should be on the very best land, where a good supply of water can be obtained. Sufficient care is not usually taken in the choice of suitable nurseries. On this choice, particularly if the weather conditions are unfavourable, often depends the success or the failure of the crop, and therefore the selection of good land cannot be too strongly emphasized. The nursery should be flooded as soon as possible after forking and levelled ready for planting seed. During the four weeks that the seedlings are growing in the nursery the cultivator must turn his attention to the land for the general planting. It has to be forked or ploughed, levelled and prepared for the young plants that are to be transplanted. The breaking down of the soil after the forking is usually done by the hoes or by means of primitive harrows, and levelling is accomplished by dragging a log of wood backwards and forwards, or by inverting the harrow and drawing that across the beds. The land should resemble 'drift mud' before it can be considered to be in a first-class condition for transplanting, but this thorough breaking up of the soil should not be more than 4 inches in depth.

SELECTION OF VARIETIES.

Varieties of rice are very numerous, and 200 of them have been experimented with at the Experimental Fields since 1903. The best varieties of rice cultivated in other rice-growing countries have been obtained and submitted to very careful comparative trials as to their yielding powers under conditions similar to those existing on the coast lands of the colony. From these varieties, three, viz., Nos. 75 (Suthra dhan), 3 and 6 have consistently given better returns than the Creole varieties, and large quantities of their seed paddy have been distributed free to numerous growers. These varieties are all long-grained, such as are demanded by the local rice market, and they all possess good milling qualities.

The Agricultural Superintendent thus describes them:—

"Creole.—Grain long, very slightly tipped at apex with red spot, light green, awns absent; stalk dark green, very slightly tinged with purple. Growth medium to vigorous.

No. 3.—Grain long, light green, ends tipped, awns absent; stalk green with a faintest touch of purple. Growth vigorous.

No. 6.—Grain slightly tipped at apex, light green colour, awns absent; stalk dark green, very slightly touched with purple. Growth medium to strong.

No. 75.—(Suthra dhan)—Grain long light green with red tips, awns absent; stalk dark green tinged with purple. Growth medium to vigorous."

Nos. 3, 6 and 75 are all of the best type and apparently are closely allied to the Creole rice of the colony. Barley-grained varieties have also been experimented with, and small quantities are being grown experimentally in order to serve for seed, should the condition of the market at any time demand a barley-grain. While fresh importations of other varieties will take place from time

to time, it has been decided that the best results are likely to accrue from selection in the different varieties that give satisfactory results. In 1909, a large number of variants have been chosen out from the Creole, No. 75, No. 3, and No. 6, as well as from other varieties. These will be submitted to careful trial, in order to obtain, if possible, better varieties than are on hand at present.

SELECTION OF SEED.

The local market demands a long-grained type of rice, and cultivators should be careful to select only such varieties as meet with ready favour with the millers.

The paddy distributed by the Board of Agriculture is practically pure to type, but unless great care is taken in the selection of seed, a rapid deterioration in quality may take place. A large number of growers go to the mills for their seed paddy. They pay but little attention to the quality of the seed selected, and naturally the results are not as satisfactory as they should be. Others keep back paddy for planting purposes, and here again little or no thought is taken as to selecting only the very best. The grower should always use the best possible seed for planting purposes. It should be a clean uniform sample, and the individual grains should be well filled. Careful selection of seed paddy is a matter of the utmost importance. Not, however, is it of importance to the grower alone, but also to the miller and the consumer. Mills can work a uniform sample of rice much cheaper than a mixed one, the product is more saleable, and as competition becomes keener, the millers will naturally look to the most careful cultivator. Growers should commence to select their seed, and the millers should see that their selection is along the right lines. The seed which is supplied by the Board of Agriculture is distributed expressly for seed purposes. That which was distributed this year is intended to be increased sufficiently to be spread over a wider area next year, All growers that receive seed from the Board should reserve what they obtain from it for seed next year, and if they obtain more than they require, they should offer it to the mills expressly for seed purposes. Seed selection is of paramount importance for the successful furtherance of the industry, and the sooner the present suicidal policy of using almost any sample of paddy, no matter how inferior, for seed purposes is completely suppressed, the sooner will the general returns be increased and the quality of the paddy improved. One of the most promising signs of progress in the rice industry will be when growers obtain their seed paddy from others who make a speciality of growing rice of the best quality purely for sale for seed purposes.

SOWING OF SEED IN THE NURSERY.

Practically no rice is sown broadcast for the several crops in this colony. Seed is sown in the nurseries and the general crop is transferred therefrom. Seed selected for sowing should preferably be placed in a bag and soaked in a trench for 24 hours. The bag should then be taken out and placed on dry land in the shade and covered down. The heat of the germination of the seed causes them to burst, and even to sprout slightly. This soaking is advantageous because it makes it possible to see what proportion of seed germinates, and thereby assists the grower in sowing a sufficient, but not wasteful, quantity of seed for his crop. It is also generally accepted that ducks prefer hard paddy and do not very often trouble that which has been soaked.

The seed beds in the nursery must be carefully prepared. They must be perfectly level. The levelling can best be accomplished by dragging a weighted board over the surface. They must be moist, and no water should be on the surface, or otherwise the seed will rot. Sprouted seeds should then be thinly broadcasted and the surface of the beds kept moist by allowing a small quantity of water to gently flow over them or by watering with cans. On no account must water be allowed to remain over the surface, or the seeds will rot. When the seeds commence to grow and take root the water is allowed to remain, and the larger the seedlings grow the deeper may be the water remaining on the surface.

TIME OF SOWING.

Sowing of seed in the nursery should commence at the end of March or early in April if the best results are to be expected. There can be no doubt whatever that the best crops are only to be expected when attention is given to the time of sowing the seeds. Growers seem to have recently attempted to sow rice all the year round, with the result that many of their crops have not paid for the labour expended upon them. *Low returns are largely the result of planting at the wrong time of the year.* If seeds were planted in the nurseries in March or April, and the seedlings transplanted in April or May, higher general returns would be obtained, and the con-

dition of the rice industry greatly improved. It would be interesting to ascertain how much rice was practically thrown away last season by not adhering to the correct period for planting. A very large quantity was lost by drought shortly after the seedlings were transplanted into the fields, and a still greater quantity was lost by the rice coming to maturity in the wet season. Where irrigation is not under absolute control, there is always a danger of loss of a crop by drought if planted out of season, and the grower should always bear in mind that rice cannot properly ripen or be satisfactorily gathered in wet weather. Planting should be carried out so that ripening takes place in the dry season.

Quantity of Seed Necessary.

The quantity of seed necessary to plant an acre is calculated to be from 8 to 10 gallons according to variety and to germination, and it should always be remembered that the sowings in the nursery should be 'successive,' *i.e.*, sown in just sufficient quantities as there is labour available for transplanting. For example:—A man intends to cultivate 8 acres of rice, and will require say 80 gallons of paddy. This should not be all sown at one time, but should be sown in four lots of 20 gallons each, the first lot the last week in March or the first week in April, the second the following week, and so on, so that the first two acres are planted up during the end of April or during the first week in May, the second in the following week, etc.

The reason for this is obvious. It is the most economical method of distributing the work. Seedling rice is ready for transplanting from the nursery in four weeks from the time of sowing, and should be transplanted before it is six weeks old. After six weeks the plants commence to joint at the base, and if then used for transplanting they remain stunted, do not tiller, and consequently give unsatisfactory returns. Sowing larger quantities of seed at any one time than can easily be handled is therefore an utter waste of time, trouble and money.

Transplanting.

When the seedlings in the nursery beds are about four weeks old they are ready for transplanting for the general crop. The plants are usually about 12 inches high at this time, but no joints should be showing at their bases. The lifting of the plants from the nursery should be carefully carried out. It is not sufficient to simply pull the plants up—only bad results can be obtained if this is the practice. Before lifting, the soil around the roots should be loosened. This may be done by sticking the fingers of both hands round a quantity of plants, so that a good 'double-handful' of plants can be taken up with all the mud adhering to the roots. After this is done the greater portion of the mud should be washed off from the roots and the plants put on one side and gathered into bundles of about 1,000 washed plants each. These are now ready to be carried to the fields for the planters, and to save time, they should be distributed at suitable distances over the beds so that the planters can readily obtain them. The planter unties a bundle, takes out a handful of plants, washes off practically all the soil attached to the roots, screws off the top three or four inches of the top portion of the seedlings, and proceeds to dibble them in. The long straggling roots that are often noticed on rice plants ready for use by the planter are in practice always left untouched, but it is thought that it might be beneficial if they were also broken off in the same way as the top portions of the plants are removed.

The seedlings should be planted two to three plants in a hole at distances of from 9 to 12 inches apart. They should simply be pushed in the soft mud to the depth of one to two inches. The planting of three plants in a hole is considered to be the safer, and the distance between the plants depends upon the variety. For the Creole variety and Nos. 75, 3, and 6 any distance not less than 9 inches or more than 12 inches will give satisfactory results, but it has been found that the finger grained varieties experimented with give better returns if planted about 6 inches apart. A selection of plants as they are taken from the nursery, and as they are being planted should be carried out as far as is practicable. Only the strongest plants should be used.

Experiments have been carried out at the Botanic Gardens in planting single plants to the hole. The results have shown that satisfactory returns can be obtained by this method, and that a considerably less quantity of seed per acre is required, but the extra expense incurred in separating the seedlings and in planting them separately is not usually commensurate with the saving made in the seed paddy. It cannot, therefore, be recommended that the seedlings should be planted out singly, especially where irrigation is either impossible or where it is unsatisfactory. Three plants per hole is our general recommendation for this colony.

After-Cultivation.

Plants after transplanting usually lie 'flat' for a day or two and then commence to stand upright. In a week, if the land has been well prepared, they will have taken root. In irrigable areas as soon as a bed has been transplanted, water should be cautiously run on and its depth regulated, but in any case it must not be more than 2 inches deep until the plants have taken root. The rice is now kept irrigated until the ripening stage is reached, and the depth of the water should be from 2 to 3 inches as a minimum, 5 to 6 inches as a maximum, the depth being regulated according to the growth of the plants. It is estimated that a crop of rice in this colony, to give the maximum returns, requires from 12 to 18 acre-inches of water per year according to the season, in addition to the rain that falls. Planters of non-irrigable rice lands are wholly dependent upon the season for satisfactory returns, and therefore they should be most particular to adhere to the proper sowing and planting season of April and May.

Two weedings should generally be given to a rice crop after it has been transplanted. These are usually given in the early period of growth, for transplanted rice soon commences to tiller and therefore satisfactorily keeps down weeds.

Manuring.

In British Guiana applications of manures are not given to rice. Leguminous and other weeds are allowed to cover the beds after the rice is cut, and this material is usually either forked or ploughed in. It is possible that at a later date it will be of advantage to sow leguminous crops in the 'off' parts of the year to be forked or ploughed in as green dressings.

Where rice becomes 'lodged' (or 'laid') it is evident that the land is sufficiently rich in nitrogen to grow large quantities of straw, and that nitrogenous manures are not required. After continuous cultivation for some years, the readily available nitrogen may become exhausted. Experiments at the Botanic Gardens indicate that phosphates may be desirable as manure for rice, and that potash will be required after a few years of continuous cultivation. Bush water contains a relatively large quantity of nitrogen and potash, and where this is used for irrigation it may not be necessary to consider the application of any artificial manures except possibly that of phosphates. Applications of lime are not advisable. A considerable waste of rice straw is occasioned every year by burning, and it would be worth while considering whether this could not economically be made into manure to be used in the nursery beds, for it is generally recognised that the nursery should be manured wherever possible.

In some rice-growing countries, especially in Japan, the question of manuring is regarded as of great importance, and numerous researches are being carried on with regard to it. Preference is given to applications of vegetable composts, animal manures, and of other organic substances. The application of bone dust has been found profitable. The investigations however are showing that on land deficient in nitrogen, and where the irrigation waters supply but little nitrogen, application of sulphate of ammonia, of lime-nitrogen and, in places, of sodium nitrate are efficacious in materially increasing the yield of the cereal.

Period of Growth and Reaping.

The period of growth varies with the variety. It is usually about four months, but may extend to as much as six months. Several early maturing varieties have been experimented with, and it has been found that whereas they retain their power of early maturity during the first one or two crops, they later adapt themselves to the conditions of the colony, and take about the same period to reach maturity as the local varieties. Early maturing varieties usually give a smaller total crop, and the returns of paddy per acre are generally less. If it is desired to plant early maturing varieties, it will be found necessary to import fresh seed from its country of origin at short intervals.

As the heads begin to change colour and the grain reaches the 'dough' or 'ripening' stage the irrigation water should be entirely run off. Ripening now takes place, and it is essential that the beds should be kept quite dry, or otherwise the proper degree of hardness of grain is not obtained. The ripening takes from two to three weeks, and when the grain is full and sufficiently mature it is cut by hand. In India, it is the common practice when the standing crop is fully ready for reaping to 'fell' it flat to the ground with large bamboo poles, for it is thought that reaping is thereby greatly facilitated. This practice might be given a trial in this colony, where the rice has not been 'laid' by rain or wind storms.

The cut rice is either beaten out immediately or bound into sheaves and left for a day or so on the beds or upon the dams, or 'stooked' (or 'shooked') up

in the fields. The different methods appear to differ with the varieties grown and also upon the degree of ripeness when cut. Some varieties have to be threshed out as soon as possible, or otherwise a considerable quantity of paddy is lost, while with other varieties the grains adhere strongly, and then it is an advantage to tie up the rice into sheaves and leave them on the dams or make 'stooks,' as it thereby dries and threshes out better. It would appear that if there is any uncertainty as to weather, 'stooking' would be preferable to leaving the sheaves thrown on the dams.

Threshing and Winnowing.

Threshing is done by hand either over a cross-bar of wood or on a sheet spread on the ground, or by trampling by oxen. Winnowing is usually accomplished by hand. Winnowing machines are being used by some growers, and if their efficiency were generally recognised it is probable that their use would become more common. Where a single grower might not be justified in purchasing a winnowing machine, a few growers combined together might have sufficient rice to warrant its purchase. Steam threshing machines could not under the prevailing conditions of rice culture be used to advantage in this colony as means of transport are not available, nor could such machines work satisfactorily in the fields themselves.

All rice after it has been threshed out and winnowed should be stored in a dry place, as far as possible away from the reach of vermin. Rats and other vermin should be destroyed if they become at all numerous.

The average local yield is about 21 bags of 120 lbs. of paddy. The average returns for the last twelve years is shown in the following table:—

Year.	Yields in bags of 120 lbs. of paddy per acre.	Rainfall inches.
1898-1899	18·4	49·9
1899-1900	16·9	52·7
1900-1901	20·0	88·9
1901-1902	20·7	81·3
1902-1903	18·5	94·5
1903-1904	19·8	99·2
1904-1905	19·2	101·1
1905-1906	18·5	74·1
1906-1907	28·4	112·8
1907-1908	23·0	126·3
1908-1909	25·4	91·1
1909-1910	22·1	100·5
Means 1898-1910	20·9	89·36

The table shows that on the whole the average returns are not governed by the annual rainfall. The yield depends far more on the distribution of the rain during the year; and especially during the crop season, than on the total precipitation. It varies with the seasons in different districts and yields of 35 to 40 bags are not uncommon. With attention, the average yield ought to be considerably raised. In some countries the average yields are stated to be from 60 to 80 bushels per acre which is equivalent to 24 to 32 bags of 120 lbs.—yields in excess of the local ones. In India from 15 to 20 bags are reported as being obtained at Experiment Stations, whilst the general yields are only from 9 to 14 bags per acre according to land, climate, and mode of cultivation. In Burma the average yield is said to be 14 bags per acre. But rice growers in British Guiana with average yields of 21 bags per acre cannot, owing to the higher value of labour, compete commercially with the yields of 9 to 14 bags obtained with the cheap labour of India and Burma.

Enemies.

Birds are the chief enemies to the rice crop of the colony. Ducks destroy a large quantity of paddy sown in the nurseries, but they prefer hard paddy and therefore the damage can be reduced to a considerable extent by soaking the seed before sowing. Many other kinds of birds feed on the rice during the growing season or as it is ripening. Their averages can be kept down to a great extent by scaring.

The rice bug and a small sucking fly are common insect pests; but their attacks have fortunately up to the present been localized. Recently, attacks by a fungus have been noted. This turns the paddy a dark-brownish colour and renders the rice grain opaque. This disease is being investigated at the present time.

Suggestions for Improvements.

A certain area should every year be set aside by every rice grower on a moderate scale for seed paddy for the next crop. The best land should be chosen and only the best paddy sown. It would be of advantage if only seed obtained from the Board of Agriculture were this year sown in these specially selected plots. This rice is practically pure, and would constitute a good sample to commence with. Before sowing the nursery, it should be picked over by hand in order to remove any bad grains. In every sample of rice there are always some bad grains, and these should be removed if it is being used for the

special purpose of raising seed for the next year. All black grains should also be picked out, as they tend to spoil a sample of yellow paddy, and they soon increase to such an extent that the paddy can only be classed as 'mixed.' When these specially selected rices come into ear, they should again be gone through, and all the heads having undesirable characters should be cut out. All red-grained rices, black rices, and barley rices should be removed. If this is done, an excellent sample of paddy will be obtained for the next sowing and a more uniform crop will result, whilst, most probably, increased yields and an improvement in the paddy to be offered for sale will be accomplished. If every grower would attempt to improve the rice to be used for seed-purposes, a great improvement would soon result and rice of a much more uniform character would be obtained. Increased yields and increased prices for any kind of crop can only be obtained by a careful attention to the selection and propagation of material for seed purposes. Rice is in need of just such care, if better results are to be looked for. The Board of Agriculture supplies pure strains of high class paddy. They should be made the starting point for growers to improve their seed paddy and thereby increase their returns and their profits.

J. B. Harrison,
F. A. Stockdale.

4TH INTERNATIONAL CONGRESS OF RICE-CULTURE,

And International Exhibition of Rice-Culture and Irrigation at Vercelli.

(Translated from the *Italian Notice* by J. C. Willis.)

At Vercelli, chief town of a rice-growing district *par excellence*, and lying conveniently near to other Italian rice-growing districts, there will be organised the Fourth International Congress of Rice-culture to be held in October, 1912.

There will be dealt with vital questions of fact regarding rice culture and its technique, rural and social economy, hygiene, and commerce, as well as similar subjects relating to irrigation.

The Exhibition will be of particular interest in that it proposes to collect all that concerns rice-culture or irrigation, to give an idea of the progress made, and of the present state of affairs.

Italy, where rice-culture has a great importance, and where the most ancient and classic, as well as the most perfect examples of irrigation are to be seen, and where such problems are most urgent for its arid regions, may justly be the initiator of such special exhibition.

In the Exhibition will be collected as much material and machinery as is necessary for cultivation, harvesting, drying, commercial preparation and working; there will be shown commercial rices, rices selected from seed, rices worked up and destined for export, or for internal consumption, and of products derived from rice; there will be exhibits illustrative of fish culture in rice districts, of hygiene, of the combating of malaria, of agrarian associations, organisations for collocation of work, for rice-cultural industry, and for technique.

It is proposed to have a show retrospective of the cultivation and industry of rice.

In the exhibition of irrigation it is proposed to show the various systems of irrigation, of derivation of water, anicuts, wells, lifts, water-measuring, machines applied to irrigation, monographs, etc. The detailed programme will be published early.

PADDY CULTIVATION IN CEYLON DURING THE XIXTH CENTURY.

By E. Elliott.

(*Continued.*)

The Second Period, 1838-56, opened with a series of important measures intended to improve the welfare of the people and advance the interests of the Colony as proposed by the two Commissioners already referred to. In 1831 Sir Wilmot Horton, Bart., assumed the Government, and shortly afterwards effect was given to several measures, such as the establishment of a Legislative Council, a new Charter of Justice and abolition of *Rajakariya*. The Governor had accepted the office on a reduced salary (£8,000), and was further instructed to effect reductions in the Civil expenditure to the amount of £40,000. In carrying out this, important changes were made in the arrangements of the Executive offices entrusted with agricultural interests, that it will be convenient to notice them at this stage.

In 1816 the Civil Service was constituted as follows: *First-class*—consisting of the Chief Secretary to Government, £3,000; Commissioner of Revenue, £3,000; Accountant-General, £2,000; Civil and Military Paymaster-General, £2,000; Civil

Auditor-General, £2,000; Comptroller-General of Customs, £1,600.

The *second-class* included eleven Collectors of Districts,* six Provisional Judges, two Sitting Magistrates and five other officers on salaries ranging from £600 to £1,800.

The *third-class* consisted of five assistants to the Collectors of Colombo, Jaffna, Chilaw and Matara; the Postmaster-General and six assistants in other departments; and the maximum salary was £550.

A service of at least eight and three years (exclusive of leave to Europe) was necessary before promotion to the first and senior classes.

A civil fund, originally established by Mr. North (raised by stoppages from salaries and contributions from Government), provided pensions of £600 per annum, payable to those in receipt of £2 000 a year, and £500 for all receiving £1,500. There was also a widow's pension of £300 a year, and there were eleven on the fund in 1841.

Of the gentlemen who had belonged to what was thereafter known as the *old* Civil Service, the last survivor was Sir Charles P. Layard; and the first member of the new Civil Service was Mr. W. C. Gibson, whose appointment was dated 16th September, 1832.

Besides the above establishment, there had been the staff already specified for the Kandyan Provinces, which was now abolished as a separate charge, and the whole island divided into five Provinces, with a Government Agent over each and assistants in the districts as follows:—

(1) Central Province (Hon. George Turnour) including Kandy, Madawaletenne, Matale, Nuwara Eliya and Uva districts.

(2) Western (Mr. Gisbourne £1,260) including Colombo, Negombo, Kalutara and Kahtura districts, and the Four, Three and Seven Korales.

(3) Northern (Mr. Dyke £1,200) including Jaffna, Mannar and the Wanni district.

(4) Eastern (Mr. Huskinson, £1,200) including Trincomalie and Batticaloa districts.

(5) Southern (Mr. Wilmot £1,00C) including Galle, Matara and Hambantota districts and also Sabaragamuwa.

There was also the staff at the headquarters of Government, Colombo, consisting of Colonial Secretary (Anstruther, £2,000), Auditor-General (Marshall, £1,750), Treasurer (Granville £1,750). Appointments to the Civil Service and salaries, however, remained personal, and in 1835 the number was only 33, hardly sufficient to fill the higher posts, Revenue and Judicial, so that many of the districts were in the charge of military officers and others; and the lower judicial offices were so filled where not combined with the charge of a district.

The Chief Secretary (Rodney), the Revenue Commissioner (Downing) and three others retired on pension, and so did the Chief Justice (Sir R. Ottley), but the others had apparently to submit to reduced salaries. This, no doubt, gave rise to much discontent and angry feeling, to judge by the following extraordinary statement taken from Pridham: "Though the Governor acted with great tact and delicacy, yet the unreasonable character of the persons affected by the measures, led them to give vent to their acrimony by hanging the representative of the Sovereign in effigy." He adds: "The efficacy of the Service increased, there was an unusual improvement in the condition of the people, and increased cultivation of grain by the natives."

There was undoubtedly increased activity, the record of which still remains, such as the settlement of one hundred families at Magama by Mr. Caulfield, the Assistant Agent of Hambantota. Mr. Mooyart (senior) appears to have taken special interest in planting teak, as his name is locally connected with the plantations at Tangalle, Matara, as well as in Chilaw. The Colonial Secretary and Lieut.-Governor (Mr. Anstruther) was also active and energetic, though he had only one arm. It has been handed down that on one occasion, when visiting a party working on a flood outlet, the Lieut.-Governor considered the coolies were not digging properly, so he took over a mamoty and showed how it should be done. When the tool was handed back to the workman with an instruction through the Maha Mudaliyar that that was the way he should work, the complaisant cooly gravely proceeded to dig *with one arm!* Those who think they can improve on native methods of working should lay this incident to heart.

I will now proceed to explain the nature of the administration changes affecting agriculture and the results as regards paddy cultivation more especially.

On the change of system, it was most fortunate that such a qualified officer as George Turnour was available to be-

* The Collectors were entitled to a Commission of 2 per cent. on their collections of revenue.—(*Circular of 21st July, 1808.*)

come the first Government Agent of the new Central Province. In his previous official capacity he had been responsible for the collection of the Revenue, and had no doubt looked specially into the system adversely commented on by Colonel Colebrooke.

In elaborating an improved scheme his reports show that while he sought to secure the rights of the Crown, he gave due consideration to the interests of the cultivators. His first step was therefore to get rid of the middleman renter, whose interest it was to squeeze out as much as possible from the cultivators. Content to work patiently and gradually, and knowing how suspicious Easterns are of innovation, he began by inducing the land owners to agree to deliver at the Government stores a moderate but fixed *quantity of grain* as commutation for the share of their crops due to the Crown.

After a few years of this mode of working, it was found possible to take another step forward, and fix a money value for the paddy, but leave it optional to the cultivator to discharge the obligation in grain or coin. At first the rate was nine pence, though the market value was a shilling per parah, equal to 16 pence per bushel.

This option was permitted until 1833, by which time, while the agreements still remained voluntary, it became possible to accept money only; which was of course much more convenient to Government than storing the paddy in stores, where the "wastage" was always a matter of dispute, as shown by the many pages taken up in Bertolacci's book as to the rate to be allowed.

In 1835 the revenue from paddy had increased to £33,540 for the whole island.

This able and trusted administrator (Turnour) left the Province in 1839, to act as Colonial Secretary during the absence of Sir Philip Anstruther, who had succeeded Mr. Rodney in 1833. On Mr. Anstruther's return Mr. Turnour went himself on leave, and, to the regret of all, died at Naples in 1842, singularly on the last day of Saka 1764 (10th April, 1842).

His memory is perpetuated by the Turnour prize yearly competed for by the educated youth of Ceylon. With a knowledge of the preliminary care bestowed by Mr. Turnour in the development of the commutation system and its subsequent great success on a voluntary basis, it may, I think, be said in his case that "past experience did attain to something like prophetic strain."

The papers within my reach give very full statistical returns of the paddy land in the Kandyan districts, the estimated crops, the exemptions from taxation and the Government share. From this I gather that the entire extent of *asweddumized* land in the Korales forming the present Central Province (Kandy, Matale and Nuwara Eliya) was about 58,800 acres, and estimated to give an average crop of 1·06 million bushels of paddy, inclusive of 435,000 bushels from exempted lands held by temples and headmen, and consequently not liable to taxation. In Four Korales, then in Mr. Turnour's charge as Revenue Commissioner, the figures are for land 18,760 acres, estimated to produce 450,000 bushels including 190,000 from exempted lands.

In Nuwara Kaláwiya (also under the same authority) the land was 5,176 amunams yielding on an average 283,000 bushels of paddy, including 18,000 from exempted lands.

Besides Mr. Turnour's district reports, there is ample evidence that preparations were made for the introduction of the new system of collection in other Provinces, and there are numerous letters printed in the Sessional Paper from the Government Agent of the Northern Provinces, Mr. Percival Acland Dyke, a Devonshire gentleman, who began life in the Royal Navy, served as a midshipman in one of H. M. Ships on the East India Station, and saw some active service—as he informed me himself at his own dinner table—which, he added, had been the mess table of his ship. In January, 1824, he was transferred to the Ceylon Civil Service, and in six weeks' time was sent to Jaffna as Assistant to the Collector. With the exception of about 2½ years at Trincomalee, first as Judge and then as Collector, and a short spell very much against his wish as acting Auditor-General in 1843, the remainder of his long service was in the Northern Province, from 1829 until his death in 1868. During this long period the only leave to Europe he took was for a few months in 1861, returning before it had expired, and taking over his duties. He became on the change in 1832 Government Agent of the N.P., and in introducing the new system of commutation was, he records, met with considerable opposition from the headmen and the upper classes who had been contented with the renting system. However, the revenue returns show nearly $\frac{6}{7}$ of the total grain revenue, for the district in 1834 was collected on commutation agreements in money, and $\frac{9}{10}$ by 1839. Mr. Twynam reports later that

the system worked fairly in the Jaffna Peninsula, and the agreements (which were optional) as they expired, were renewed for terms varying from 7 to 12 years (twelve times since 1834). But that in the mainland districts it did not work well, the people failed to pay, and it ceased to be in operation in 1847, but the recovery of the ai rears were not completed till 1859.

While this is interesting as bearing on the efforts made to encourage the cultivation of paddy, unfortunately these papers do not supply any statistics of extents cultivated or the probable crops, except that the number of separate holdings of paddy land entered on the commutation registers of the Jaffna Peninsula was 101,204.

In the Western Province Mr. W. Gibson (who died in 1839) was Government Agent, and no information is available except that in 1855, the then Agent (Mr. C. P. Layard) reported that in the districts of Colombo, Kalutara and Negombo, the area offered for commutation between 1837-47 was 105,268 bushels, about 44,000 acres. These figures shew advances of 14,000 acres on the extent at the end of the Dutch regimé, as shewn by the last *thombu* of the "Colombo Dessavony," which was summarised by General de Muron for a Committee which sat early in the century. (General de Muron was the Commandant of the Swiss Regiment in the Dutch employ and surrendered at the siege of Colombo. He passed into the service of the Indian Government.)

In the Eastern Province Mr. Blair was the confirmed Government Agent, but Mr. J. G. Forbes was acting (in 1835). It is reported that the new system was early introduced into the Batticaloa district, so far back as 1832, when without any regular assessment being made, the people were allowed to commute at an average of what they had paid in kind for the nine years previous; the second and third assessments in 1840 and 1850 respectively were based on this arrangement. In the latter the extent of land under cultivation was returned at 62,000 bushels (say 20,000 acres) assessed at Rs.10,200, and the revenue for paddy commuted and uncommuted averages only Rs.9,700 between 1850-5. Besides the commuted lands there was a considerable cultivation of excess land which yielded only a small revenue, until the renting system was in 1856 reformed, and the revenue rose to Rs. 23,900 (av. 1856-59).

A new era dawned for Batticaloa, when Woodford Birch, who had served as office Assistant Agent at Trincomalie, was appointed to Batticaloa in 1856; but the development of the district under his vigorous regime will come under the third period of this history, and I may close this by noting that the grain revenue of Batticaloa for 1857 was only Rs.19,359, though there was a good N. E. at end of 1856, but a very dry January.

In the *Southern* Province in 1835 Mr. Wilmot was Government Agent, and the Province included Matara and Hambantota Districts, as it does now, and Sabaragamuwa besides (Mr. W. Moir assistant), as well as Aliport, to which Mr. Charles P. Layard was posted on his return, married, from leave in May, 1835, and the young couple had the unique experience of having the thatch pulled off their house by elephants. His predecessor there was the well-known sportsman Major Rogers, then posted to Badulla, and who is said to have shot 2,000 elephants. A good riddance, too, as was brought home to me when on circuit in the Bintenne of the Eastern Province in 1890, and some villagers complained of the increase of elephants. "Pissudoduwa, nonsense," said the old Ratemahatmaya, who was, I believe, a gun-bearer in his youth to the great sportsman—"nonsense, if you get out of the way up a tree, you can get down in two or three *peyas*, but in Major Rogers' time, if you got into a tree, the *nekatha* (lucky hour) would not come for *three weeks*. Don't talk nonsense, have you any true complaint to make to the Agent?"

In Sabaragamuwa the period opened badly and the grain rent only yielded Rs. 3,908 (in 1831) owing to the year being one of failure agriculturally, though in ordinary years there was apparently a surplus of paddy, as the Government share, then collected in Anmani, was sent away by boat in compliance with requisitions of the Commissary General to feed the troops at Colombo.

In 1831 it is interesting to note that Government offered to accept payment of the tax in *cotton*, then generally grown in the Bintenne Chenas; to this the Agent replied the people required all the cotton for their own use, but that the villages in the low country between Avisawella and Ratnapura were prepared to pay their tax in arecanuts!

The commutation system was introduced in 1833, and was accepted to some extent, but by 1841 it had fallen into arrear, and the farming system was reverted to.

The extent of land is stated to have been in 1869 6,754 amunams, including that held by Chiefs and other headmen,

and 2,512 held by Temples. Mr. Wace in his report (1889) regretted he was unable to find the figures for the lands included in the first registers of 1833 in the Ratnapura Kachcheri. Strange to say, I have had the good fortune to find them in a Devonshire rectory! where lives the Rev. H. Mooyaart, M.A., once a well-known Ceylon civilian, but now the highly respected Rector of Up Lowman, and in his 80th year, but I am glad to say hale and hearty and as fluent as ever in his Sinhalese. He recently permitted me to peruse his report as Assistant Agent of Sabaragamuwa for the year 1857, and in which I found the missing figures! which are as follows, —liable to tax 11,128 amunams, exempt as temple property 3,016, making a total of 14,145.

The Seven Korales, though attached to the Kandyan Province until 1832, receive no mention in Mr. Turnour's reports, and there is no information regarding it in the Sessional Paper I have found so useful in this notice—probably because apparently the commutation system did not prove suitable or acceptable, in consequence of the vicissitudes to which paddy growing in that part of the island is liable, and earlier possibly on account of the unsettled state of the country, as the old Government Almanacs (from which I made copious extracts early in my career) disclose that the Assistant Agent of the district as late as 1838 was a military officer, Capt. W. Timbrace, on a salary of £250, and the D. J. was a Capt., E. Macpherson, apparently in addition to their military duties and pay.

In his Eleven years in Ceylon, Forbes who visited the station, records:—"Kurunegala is one of those places which lie on the track of elephants in passing across country, and although no obvious reason can be seen to justify this preference of this particular line, yet they adhere to it with uncommon perseverance, the formation of seven or eight roads converging at this place, which owes its existence of late years to the military station and headquarters of the revenue and judicial officers of the district being established here, is insufficient to induce the elephants to abandon their former route, and they continue to pass through this large village to the great annoyance of its inhabitants. Their pertinacity does not abate, although their numbers have been considerably diminished, for the late Agent, as well as his predecessors, was a keen shot and a successful one. He killed *nine* in one afternoon, the greatest number known to have been bagged by a single sportsman."

I find the name of Dr. Luke Kelly as stationed here in 1835 as Assistant Colonial Surgeon; he was one of those medical men brought out by Government to strengthen the civil side of the "Vaccine Establishment" as it was called, which was under the control of the Military Principal Medical Officer (Dr. Foster). He was the father of Mr. Lilly Kelly, well known of late years as an estate proprietor and planters' member of Council in the nineties.

Another was Dr. Grant who was stationed at Ratnapura, and the third was Mr. Christopher Elliot who was stationed at Badulla. The latter resigned after a short service, but the other two were subsequently transferred to the Army Medical Service.

In 1838 a regular civilian was appointed to Kurunegala as Assistant Agent and District Judge, but the Seven Korales remained under the control of the Colombo Government Agent until 1845, when the districts of Kurunegala, Puttalam and Chilaw were separated to form the North-Western Province. The Agent was, however, located at Puttalam, salt being evidently of more importance than paddy or population, until June, 1856, when the headquarters of the Province were moved to Kurunegala—the capital of all Ceylon during the time of the four kings who succeeded Prakramabahu III.

About this province the information I have been able to gather is very meagre. Pridham's enquiries went to show that the northern portion of Wanni Hat Pattu was, about 1845, "little better than a desert from the ruined state of most of its numerous tanks." To the Devonshire Rectory I am again indebted for reliable statistics, as the worthy Rector's Colonial life included two years (1854-6) of service as Assistant Agent of Kurunegala. His report for 1855 is most interesting reading, and in the body reference is made to a complete return of the paddy land in each village and other cognate information, which would be most useful for my present purpose; but alas! though there are copies of several other returns, this one is missing. But luckily there are figures in the report itself which show that the area cultivated for both Maha and Yala of the five years between 1850 and 1855, ranged from 2,173 amunams (including 701 for Yala) to 5,469 (in 1855, including only 67 for Yala); and the average was 3,000 amunams, say 9,000 acres at most, inclusive of 771 amunams (say 2,300 acres) for Yala alone.

The revenue for 1855 was £5,611, and making allowance for a probable increase in the price of paddy, owing to short

crops for the previous two years, and also for the exempted lands of temples and headmen which did not contribute to the above sum, the crops were certainly three-fourths and may have reached a million of bushels; a result, doubtless, due to the plentiful rainfall of the last quarter of the previous year, which I found by an old copy of Ferguson's Directory (the Rector's property) was 87 inches with good S.W. and N.E. monsoons, while the failures of both the little and big S.W. monsoons of 1855 fully account for the very small cultivation (150 amunams) for Yala.

In parting with this district it will be of interest to give a derivation of the name Kurunegala, for which I am indebted to Mr. Mooyaart, and which I do not remember having ever heard while in Ceylon, and which does not form one of the several given by Pridham. It is කුරුකැටි නෑසමූහයක් විසූ හෙයින් කුරුණෑගල නම් විය, which may be translated—"from a race of dwarfish people came the name Kurunegala."

To *Uva* came Capt. Rogers of the Ceylon Rifles on being relieved at Aliport by Mr. C. P. Layard, and acted as Assistant Agent (on a salary of £350 in addition, I presume, to his military pay as Commandant), and also discharged the judicial duties on another £135 until relieved by the appointment of W. G. Forbes at end of 1842, but continued to be Assistant Agent until his death in 1845. Associated with him I find as Assistant Colonial Surgeon Mr. Christopher Elliott, father of the writer, who, finding the duties uncongenial, resigned and went to Colombo, and continued the practice of his profession and journalism, until appointed Principal Civil Medical Officer in 1858.

From the *Uva* Manual (White's) and from a report by Mr. John Bailey in 1856 (published in the Sessional Papers) I gather the following facts: Previous to 1832 the grain revenue of Badulla amounted to only £539. The Commutation system was early introduced into this Division, and the revenue increased from £858 to over £1,080. With regard to this Turnour wrote to Rogers in 1836 that the rate in Bintenne was too high, and Walapone was too low, but it was done advisedly owing to inaccessibility and poor soil. He further urged on his Asssistant not to attempt to enforce the new Commutation, *unless convinced of its moderation*. Under such sensible and considerate instructions, Rogers carried out a fresh settlement in Badulla for 21 years, based on the value of paddy adopted for the previous assessment, 4 to 12 pence per bushel. In after years Bailey, when Assistant Agent, expressed regret that the possibility of an increase in the value of Paddy consequent on the development of the District had been overlooked, and that the agreement was for such a long period.

Other settlements for the Aliport Division had been carried out for shorter periods, generally four years taking the value of paddy at the old prices. So the Badulla people got off very cheaply, especially in the more remote portions of *Uva*. But when these old settlements expired, there was a heavy advance which will be noticed elsewhere, but no substantial addition was made till 1864.

The total paddy land in 1854 in *Uva* is reported to have been 33,000 acres, of which say 7,800 was exempted from taxation as property of temples and headmen, and 2,400 were waste.

Concurrently, with the introduction of the new commutation, there was certainly an increase of the grain revenue from £25,000 (the average of the five years prior to 1830) to £35,340 (average 1833-8); while the average of the next five were £36,677. But though the condition of the cultivator was undoubtedly ameliorated by the considerate assessments, especially in the Kandyan districts, there was on the other hand a steady disorganisation of the old communal co-operation so essential in paddy cultivation, consequent on the unrestricted abolition of *rajakariya*. There were those who noted the adverse effect of this measure, but these were more immediately apparent in the deterioration of the thoroughfares of the island, and then led to proposals for a modified substitute applicable to the upkeep of roads only, for which funds from the general revenue were not available, as the financial condition of the Colony in the forties was far from satisfactory. The revenue which had risen from about £285,000 in 1826 to over £437,000 in 1833 fell to £322,369 in 1842, and the expenditure had exceeded the income by £95,600 in the six years 1837-42.

Fortunately about this time European capitalists interested in the cultivation of sugar and coffee appeared on the scene and created a demand for land, the upset price of which was raised (June, 1845) from five shillings to one pound per acre. This added considerably during the next two years to the revenue, which rose to over £454,000; but as sugar proved a failure and coffee did not at first prove a success, the revenue again proved insufficient, and there was an excess of expenditure during the four years (1846-9) of nearly £186,000.

Sir Emerson Tennent, who I believe was considered a financial expert, was appointed Colonial Secretary and arrived in the island in November, 1845. The condition of the finances of course occupied his early attention, and in October, 1846, was published his report on the Colonial revenue, with suggestions for securing an increase therein.

Concurrently Mr. Philip Wodehouse, Government Agent of the Western Province, made the proposal that every male inhabitant of the island between the ages of 18 and 55 years should be declared liable to contribute six days' labour, free of payment to the formation and upkeep of the roads of the island, with the option of commuting the liability to a money payment. Sir Emerson Tennent desired that a portion of this labour should be applied to the repair of tanks, but this was vetoed by the Secretary of State, and the Ordinance as finally passed in 1848 restricted the application of the labour to roads.

In his financial report Sir E. Tennent gave figures of the revenue from paddy and fine grain, and pointed out that "while the cultivation of every other description of produce has been making advances, the production of corn is absolutely stationary." This he attributed to the renter and the farming system, and suggested the substitution of a general land tax in lieu of this and other imposts which he thought it desirable to abolish. Nothing came, fortunately, of this proposal, but in the inference he drew from a comparison of the year's revenue figures, he much understated the case, as he did not take into consideration the *increase* in the price of paddy in the period reviewed.

It would have been more satisfactory to base an enquiry as to the extent of this retrogression by reference to the Agricultural returns in the Blue Books of the period, but they are not available. They had been removed from the Library of the Colonial Office in London to the Public Records Office, but on applying there they could not be found. I am consequently obliged to deduce the probable production of the period from the available data in my possession, chiefly the actual recoveries on account of the Government share and the current prices of paddy.

On these points the records show that

(*a*) The annual average revenue from paddy was as follows :—

Prior to 1830	(say)	...	£25,000
From 1833-8		...	£35,340
From 1839-44		...	£36,677
From 1845-56		...	£39,700

(*b*) The average price of paddy per bushel for the whole island was equivalent in the thirties to about 40 cents of a rupee present currency, but had risen to at least 45 cents by 1844 ; was over 55 cents in the early fifties ; and 75 cents by 1858.

At the same time due allowance has to be made for the fact that the voluntary commutation of the Central Province and Badulla, etc., remained at the low value for paddy fixed in the thirties until after 1850.

From the foregoing data and other collateral information scattered through the papers at my disposal, I am inclined to estimate the annual average production of paddy in the island up to 1855 as follows :—

Prior to 1830	say 3½	millions	of	bushels.
Between 1833-9	,, 4½	,,	,,	,,
Between 1840-5	,, 4	,,	,,	,,
Between 1846-55	,, 3	,,	,,	,,

The provision of what was henceforth known as "Ordinance labour" remedied the loss entailed on road making by the abolition of *rajakariya*, but no similar provision was made in the interests of agriculture, and consequently tanks and other works of irrigation were neglected and change and decay was all round. Chief amongst these losses was the destruction of the great Urubokka dam erected by the Dutch, and which was destroyed in 1837, owing to the silting up of the canal intended to carry off the impounded water to the Giruwa Pattu, a work which had been formerly done by *rajakariya*, but no provision was made for this work of necessity on its abolition. Another serious loss was the destruction of the Kirema dam (which had been restored by Sir Edward Barnes in 1828), from similar negligence. In the Batticoloa District the Dutch had constructed large works, which had (Mr. Birch reported in 1856) "been kept in perfect order till the abolition of compulsory labour prevented the people being called out, and though once or twice temporarily repaired by a few enterprising cultivators, had at last fallen into perfect decay and are now utterly useless." He estimated that consequent on this an extent of over 60,000 acres had been abandoned.

It is not necessary to quote fuller details, it was the same everywhere. The Secretary of State had intimated his readiness to authorise outlay in irrigation works from the general revenue in return for taxation on the fields benefited. But there were no funds available, and the other measures enacted with a view of increasing the revenue

gave rise to so much trouble that a period of inaction ensued. Agricultural interests had consequently to drift until the advent of Sir Henry Ward as Governor in 1855—and a wave of general prosperity set in, as shown by the Revenue of the island exceeding £500,000 for the first time (1856).

(To be continued.)

ESTIMATED WORLD SUGAR INDUSTRY.

SUGAR-CANE CROPS OF THE WORLD SHOW DECIDED VARIATIONS FROM FIGURES BY FOREIGN EXPERTS.

(From the *Manila Bulletin.*)

Willet & Gray's estimate of the 1910-11 sugar-cane crops of the world shows some decided variations in the totals for the chief producing countries from figures previously published by foreign trade experts. (See Daily Consular and Trade Reports for December 7, 1910.) The foreign December estimates gave the 1910-11 season's world crop as 8.519,000 tons; the June Willett & Gray estimate places it at 8,445,178. While less than the foreign total for 1910-11 this latter figure is an increase of 119,661 tons over the American firm's statistics of the 1909-10 cane crops. The later American estimate places British India's 1910-11 yield at 76,400 tons more than the earlier foreign calculations; Cuba's at 250,000 tons less; Java's at 20,900 tons less; Mexico's at 15,000 tons in excess of the previous figures.

The estimated production in the world's cane-growing centre, according to Willett & Gray, and the increase or decrease as compared with the firm's statistics of the 1909-10 crop are as follows, in tons: Louisiana, 300,000 (—25,000); Texas, 11,000 (plus 1,000); Porto Rico, 295,000 (—13,000); Hawaiian Islands, 485,000 (plus 22,387); Cuba, 1,600.000 (—204,349); Trinidal [exports], 40,000 (—4,139); Barbados [exports] 35,000 (—1,389); Jamaica [exports], 12,000; Antigua and St Kitts, 18.000 (—2,000); Martinique [exports], 39,000 (—950); Guadeloupe, 40,000 (8,000); Dutch West Indies, 15,000; San Domingo and Haiti, 85,000 [—8,003]; Lesser Antilles, not named above, 8,000 (this estimate being in strong contrast to the 45,000 tons credited to these islands in the foreign December report); Mexico, 150,000 (plus 2,095); Guatemala, 7,500 (plus 390); San Salvador, 6,500 (plus 144); Nicaragua, 4,500 (plus 1,050) Costa Rica, 2.500 (plus 255); Demerara [exports], 100,000 (—1,843); Surinam, 13,000 (plus 945); Venezuela, 3,000; Peru, 150,000; Argentina, 147,678 (plus 34,004); Brazil, 310,000 (plus 57,000); British India, 2,226,400 (plus 99,300); Java, 1,229,100 (plus 28,482)—the estimate of Java's harvest for the 1911-12 season being 1,230,000 tons; Formosa, 267,000 (plus 62,000); Philippine Islands, 160,000 (plus 33,146); Queensland, 207,000 (plus 72,416); New South Wales, 18,000 (plus 3,250); Fiji Islands [exports], 69,000 (plus 100); Egypt), 45,000; Mauritius, 210,000 (—34,598]—the estimate of the Mauritius crop for the 1911-12 season being 240.000 tons; Reunion, 36,000; Natal, 76,000 (plus 14,000); Spain, 24,000 (plus 967).

F. O. Licht calculated the European beet-sugar crop for 1910-11 at 8,127,000 tons; Willett & Gray place that season's American beet-sugar crop at 455,220 tons; giving a total for cane and beet-sugar of 17,027,398 tons, or an estimated increase of 2,113,286 tons in the world's production over the 1909-10 season.

RICE AS A MUSCLE BUILDER.

A recent editorial in the Lancet-Clinic points out that the defeat of Russia by Japan drew the attention of the whole world to the power of endurance, exhibited by the Japanese, and that much surprise was expressed that a rice-eating nation should develop such remarkable physical power, says the *Japan Advertiser*. In the United states, as well as in Europe, rice has usually been considered an inferior food owing to the excess of starch in its composition, and this is undoubtedly true of the rice as we meet with it. But this defect in the grain is the result of the removal of nutrient matter for the purpose of making the rice more presentable for the market by what is known as the polishing process. Not only is the outer husk taken off but what is called the rice meal, which envelops the inner kernel, is also brushed away, although it is highly nutritious, being the 'albuminous' portion of the grain.

It is, however, an unattractive brown in colour. This rice meal is exported to Europe by rice-growing countries, and in England it is made into what is named oil cake with which cattle are fattened. Chemical analysis of rice meal shows that it contains about 12½ per cent. of albuminoids and 4½ per cent. of phosphoric acid, and the former appears to be easily digested by the human system.

As the Japanese, in common with the other rice-eating nations, do not polish the grain, they retain a large proportion of nutriment and flavour to which virtu-

ally all Americans and Europeans are absolute strangers.

THE AVOCADO IN SOUTHERN CALIFORNIA.

By F. W. Popenoe,
Pasadena, California.

(From the *Pomona Journal of Economic Botany*, Vol. I., No. 1, February, 1911.)

That the avocado will succeed in Southern California has been proved conclusively by the seedlings planted fifteen to twenty-five years ago which are now bearing, and by more recent experiments with budded trees; and the establishment of an avocado industry in the immediate future is assured. As to whether we shall proceed at once to the production of the best fruits, or whether the loss of much money and time with the incidental disappointment to all concerned shall be caused by the planting of inferior varieties is the vital question at this moment. It is to the solution of this problem that the earnest endeavour and careful efforts of all our nurserymen should be directed, and it is in the hope that some help may be given in eliminating wasteful efforts that this article is written.

For centuries the avocado has been grown in Mexico and other tropical countries, propagated only by seed. Like other fruit trees grown from seed, it comes true in but a very small percentage of cases. This has led to the existence of a wide range of varieties. All avocados so far fruited in California are these mere chance seedlings, most of them of indifferent value and not worth propagation on an extensive scale. There are many varieties of good size and flavour, fruiting in Mexico and other parts of the tropics which will doubtless succeed here as well as the smaller and inferior ones. Some of these Mexican varieties are of such superior quality as to leave nothing to be desired.

It is therefore manifestly the part of wisdom for California planters of this fruit to proceed with intelligence and accept nothing but the best. Attracted by the prospective large returns some investments of a doubtful character are already being made. There is really no excuse for this.

Investigation and care will lead any one in the right path. There will be no demand for seedling or inferior fruits once a superior avocado is to be found plentifully in our markets. Nor need tnere be delay or groping in the dark for these superior varieties. At our very door lies a boundless experimental garden in which for centuries the avocado has been grown, where countless varieties have originated, and where now are growing hundreds of thousands of trees from among which we have only to select the best.

By taking advantage of this opportunity California can obtain in a comparatively short time the choicest varieties, which it would take years of time and a large expenditure of money to produce by the ordinary methods of plant breeding carried on here.

The results presented in this preliminary paper on this subject have been worked up in the Biological Laboratory of Pomona College, and acknowledgments are here made for the facilities placed at my disposal there and the constant and kindly assistance extended to me.

Types Grown in California.

Broadly speaking, the avocados which have fruited here so far may be divided into two classes: those of Mexican origin, which include all the smooth and thin skinned varieties, and those of Guatemalan origin, which are easily distinguished by their very thick skins and rough exterior. This is not saying, of course, that all avocados can be divided into these two classes.

Of the Mexican type many trees may be found scattered all over the southern end of the State, most of which have been grown from seed obtained from Monterey and other points in northern Mexico. The famous Chappelow tree is the oldest and best known of the lot.

Most of the Mexican varieties produce fruits of small size, dark purple in colour, but of good quality, and are preferred by many to the large green fruits, it being the belief that they are richer and of better flavour than the larger varieties.

They are also somewhat hardier than the larger varieties, and probably will be valuable in locations where the latter would not thrive.

For home use these varieties will always be desirable, but as a commercial fruit they are out of the question altogether. They are too thin skinned to stand shipment, and would probably not take at all in American markets in competition with the larger thick skinned fruits.

A few varieties of Mexican origin and green in colour are now grown here which are larger than the purple varieties, but these also are thin skinned and

of little more value commercially than the purple ones, although the quality is all that could be desired in some cases. To be profitable commercially, the fruit will have to be thick and tough skinned, so as to stand shipment, and as yet no Mexican variety which has fruited here has this quality.

Outside of the Mexican varieties the only other type known to have successfully fruited here is the Guatemalan. The trees of this type are probably all descendants of the old Miller tree, the seed of which was brought from Guatemala and planted at Hollywood over twenty-five years ago. Numerous seedlings have been grown from this tree, several of which are now bearing. The Walker tree is the best known of these, and is the most prolific tree known here, its crop every year running into the thousands. From the behaviour of these trees it seems certain that this type is admirably adapted to this climate, a fact of the greatest importance to the future of the industry here.

In his bulletin on the avocado, Collins speaks of the avocados of Guatemala as forming a very distinct group, the most peculiar characteristic of which is the unusual thickness and toughness of the skin, and he considers them the most promising of all the types from a commercial standpoint. It is particularly fortunate, then, that this type has been tested here and its adaptability proved, for the way has been paved for the introduction of numerous forms of the type with practical assurance of success. Another noteworthy point in regard to this type is the fact that all of the local trees are spring bearers, this point alone making them of great value. Being spring bearers their blooming season is considerably later than the fall bearing Mexican sorts, so that the danger of the crop being destroyed by late frosts is almost eliminated. Already we have several varieties of this type that are well worth growing, of which the Lyon is the most promising, it being the finest avocado yet produced in California, of good size and excellent quality. This variety has just come into bearing, and therefore is little known as yet, but its prolificacy and good qualities promise to place it in the lead of the local varieties. The trees of the Guatemalan type are easily distinguished from those of the Mexican type, because more spreading, particularly when young, and the leaves are more lanceolate.

It has been the general impression that the South American type which is grown in Florida would not succeed here, but this remains to be proved. Budded trees of many Florida varieties are being tested in Southern California, and the Bureau of Plant Industry expects to send out a large number for this spring for trial. One large tree at Sherman which was worked over to the Trapp variety flowered this year for the first time, and numerous other trees are becoming old enough to bear, and will be watched with interest for the next few years. This type is certainly more tender than the Mexican, but the past few winters have shown that some varieties at least will stand our average winter temperature without injury. Future experience will likely confirm the present belief that this type will succeed in many locations here.

Numerous seedlings of Hawaiian, Cuban, and West Indian varieties have been grown, but as yet these have not come into bearing. Budded trees will have to be tested before anything definite can be said of their adaptability.

It has been stated that the avocado would not succeed in the hot and dry interior parts of California. Trees are known to have grown without injury as far into the interior as Redlands and Riverside, and have fruited heavily at Pomona and San Fernando, and should be tried at Imperial.

PROPAGATION.

By Seed. This is the simplest method, and the one most practised in California up to the present time. The seeds of most varieties are obtainable during late summer and autumn, and should be planted as soon after removal from the fruit as possible. It has been found to hasten germination greatly if the seeds are buried in moist sand or sawdust for a period of two to four weeks before planting. During this time they should be occasionally examined, and when they show signs of germinating they can be taken out and planted in pots. After this treatment they will start to grow very promptly, and it has the added advantage that only seeds that are sure to grow are planted, and no labour is wasted. For most seeds a four inch pot is large enough. The seeds should be placed in the pot pointed end up, or in the case of the round seeded varieties, the end toward the stem of the fruit, and about one-fourth of the seed left exposed above the surface of the soil. A good rich soil is essential to the best development of the young plant, and should be kept thoroughly moist, but care should be exercised to avoid standing water in the pots, as this is fatal to either the seed or the young tree. While the young trees should be grown in a

warm situation, the direct rays of the sun should be avoided. If the seeds have not been buried in moist sand before planting they will often be slow in germinating, especially if not grown under glass. Many of the seeds planted in the fall in a lath house do not come up until the following spring. After the young trees have made a growth of eight to twelve inches, they should be shifted into larger pots or cans, if it is desired to carry them on this way, or set out in the nursery to be grown until of suitable size to bud.

By Budding. It is only during the past season or two that much attention has been given to budding the avocado in California, although previously a few nursery-men most interested in this fruit had tried it. Having no experience of their own in the budding of this particular tree, most of those who have budded during the past year or two have simply applied the methods they would use for citrus fruits, while a few others have followed the instruction given in various publications by those who have experimented in Florida. In all cases the results have proved the budding of this fruit to be no more difficult than that of the citrus fruits, and when a little more experience has been acquired the operation will be performed with as much assurance of success as with the orange.

For commercial purposes plants are grown in pots until about twelve inches high, when they are set out in nursery rows three and one-half to four feet apart, and fourteen inches apart in the rows. Here they are grown and budded and allowed to remain until of saleable size, when the trees are balled, or transplanted into pots, and allowed to become established before being sold.

The method of budding is practically the same as used for the orange. In regard to such points as the best size of stock and bud and season for carrying on the work, there has, however, been some uncertainty.

Experiments have been carried out locally on stocks ranging in diameter from about one-fourth of an inch to over one inch, with budwood of all sizes, from the young and tender tops to well-matured wood of the previous season's growth. Results led to the conclusion that for small stocks, such as will be obtained during the first summer's growth of the seedling tree, buds from young wood of the current season's growth are the only ones which will give good results. On older trees, mainly two-year-olds, the buds from older wood seem to take better, but are liable to drop after leaving a blind bud.

The experience of P. J. Wester, in charge of the avocado investigations of the Bureau of Plant Industry, is unquestionably the most valuable to be had on this subject. Under date of January 4, 1911, he writes me as follows: "In 1906 I published an article in the *Florida Agriculturist* that has been reproduced in many papers, but which does not now wholly represent my views on the subject. The stock should be the size of a lead pencil, in vigorous growing condition with sap flowing freely, and young budwood, *i.e.*, that from the current year's growth, with well developed buds, used. Do not use old and hard budwood, as such buds after taking frequently drop. Cut the buds large, and cover entirely with waxed tape. The last point may not be so important in California's dry climate. Continued experimentation since I wrote the above mentioned paper shows that budding may be practised any month of the year, provided the stock is in condition, though for nursery practice I would not bud in August, September, October or November."

Regarding the best season to bud, it seems to be the consensus of opinion here that October and November, which are mentioned by Mr. Wester as undesirable months, are as good a season as any, if not the best of the whole year. This is probably owing to the climatic conditions of Southern California being different from those of Florida.

Three weeks after insertion the buds will have taken and the trees should be lopped back to several inches above the bud. The buds will then start into growth, and when a growth of eight to twelve inches has been made the stock may be trimmed back to the bud.

Edgar Harman, of Sherman, has done considerable experimental budding, and what he says will be of value to those contemplating doing this work. The seeds are started under glass, and as soon as the plants are two inches high they are set in pots and placed in a protected place in the open. When they have grown to the diameter of three-eighths to one-half of an inch they are budded. Mr. Harman considers that this operation can be performed successfully any month of the year except July and August. Young and tender budwood is used, and the buds cut from three-fourths to one inch long. Waxed cloth is used for wrapping, and the buds are not wrapped very tightly. As soon as the buds swell, which should be in about three weeks, the top of the stock is lopped over at about the fourth leaf above the bud, and a little later on it is

cut clear off. When the bud has started into growth the top is cut back to a level with the bud. The sap must be flowing freely at the time of budding to insure success.

C. P. Taft of Orange has probably had more experience in growing and budding the avocado than any other person in California. He says: "I am inclined to regard the months of October and November as the best for budding, though I think there is a short period in the spring when considerable success can be had. The buds I put in my three-year-old orchard last fall have done well and are making a fine growth. About 25 % of the buds on stocks in cans succeeded. Those put in during the warm summer months were an almost total failure."

In April, 1909, D. W. Coolidge of Pasadena budded about 150 two year-old seedlings growing in the open ground at Hollywood. The buds were taken from well-matured wood of the previous year's growth, and waxed cloth was used for wrapping. Fully 90 % of these buds took, but quite a number dropped their buds after having taken. However, fully 75 % of the buds inserted developed into trees. Mr. Coolidge has made several attempts to bud stock grown in cans, but with no success, probably because trees thus grown are not sufficiently vigorous.

William Chappelow of Monrovia, owner of the original chappelow tree, states that he proceeds exactly as in budding citrus fruits, and has budded at all seasons of the year with about equal success.

Large avocado trees which are unproductive should be cut back and budded over to some good variety. The method is simple, and as described has been practised very successfully by Mr. Harman. The large limbs are all cut back close to the trunk, and the cut ends covered with white lead to prevent bleeding. In a short time numerous sprouts will make their appearance; all of these should be cut off, but three or four of the most promising selected on different sides of the tree so as to form a good head. In a short time they will be large enough to bud, and should be budded in the same way as small seedlings. The wraps must be loosened every four or five days, as the sprouts make a very rapid growth. After the buds have made a growth of several inches the stocks may be cut back and the buds allowed to develop into the new tree. In two years' time a good-sized head will be obtained.

The best material for budding tape is cheap cotton cloth which will tear easily. The method of preparing it is described by Mr. Wester as follows:—"Rip up the cloth in strips of desired widths, say six inches, and roll these tightly on stout iron wire as long as the width of the strips. Several strips may be rolled on until the roll is one inch in diameter; tie a string around the roll at each end to prevent unrolling while being boiled in the wax. A good wax is made by boiling together two pounds bees wax, two pounds rosin, and half a pound of good lard; when in boiling state put in the rolls of cloth and let them remain for fifteen minutes, when they are taken out and cooled before being stored away. The iron wire is more desirable than sticks of wood, as the weight of the wire will keep the roll below the surface of the boiling mass. Another advantage in using the wire is, that if the sticks are not quite dry, the water, as it is converted into steam, will cause the contents to boil over."

Inarching has never been practised in California, but J. L. Hickson, of Miami, Florida, a large and successful grower of the avocado, states that he propagates entirely by this method, as he considers it produces a stronger and better growth than budding. However this may be, the method is slow and laborious, and trees cannot be produced in sufficient quantities to make it commercially practicable here.

Grafting has been performed successfully in a few instances, but has not been attempted to any great extent as yet.

Cuttings have been very successfully rooted by being placed in clear sand in a lath house, but it is doubtful if this method of propagation produces as strong a plant as the others.

ORCHARD PLANTINGS.

It is only within the last year or two that orchard plantings of the avocado have been made in Southern California, and then only in very small acreages, but the next few years will see the territory devoted to the culture of this fruit on a commercial scale greatly increased.

The trees may be planted at the same distance apart as orange trees, or if space is available at a somewhat greater distance. Budding seems to dwarf the tree, and budded trees will require much less room than seedlings. In either event the trees should not be allowed to grow to an unlimited size, but should be pruned like deciduous fruits, allowing only the strongest branches to

develop and form the head of the tree, and all weak and undesirable growths cut out each year. The top should be kept cut back to facilitate picking the fruit, and not allowed to grow to an unlimited height as has been done with all the seedlings grown here.

Transplanting should be done in early spring before the trees have started into new growth.

During the first year or two of its growth, the tree is more tender than when larger, and in locations subject to heavy frosts should be protected during the winter by some covering. Palm leaves are used for this purpose if they can be obtained in sufficient quantities, or a frame can be constructed of lath and covered with burlap or cheese-cloth. The danger from frost, however, lies not so much in the possibility of injury to the trees themselves, as in the destruction of the crop through freezing of blossoms of early flowering varieties. To avoid this, late blooming varieties may be planted, such as those of the Guatemalan type, which bloom so late in the spring as practically to eliminate danger from this source. It is only occasionally that the Mexican varieties are caught, but as the crop is practically certain to be lost, if a very heavy frost occurs during the blooming season, the only safe way will be to plant late blooming varieties.

The tree requires about the same irrigation as the orange. Insufficient irrigation will result in small fruit.

In selecting varieties for planting on a commercial scale, there are a number of points which should be kept in mind. Fruits which ripen during midwinter will command the highest prices in the markets, and there will probably be the greatest demand for avocados at this season of the year. As to size of fruit, there is no advantage in having the very largest. While a two pound avocado is a regal fruit, for practical purposes one of half that size is better. Quality should be one of the most important factors in choosing a commercial fruit, and other desirable points are prolificness, a smooth thick and heavy skin which will stand shipment, good keeping qualities, and a small seed, completely filling the cavity, as a loose seed pounds the walls in transit, causing early decay. We must, however, have still smaller varieties for cheaper trade, and summer varieties for local consumption, and we already have a good assortment of varieties to choose from for these purposes.

THE FUTURE OF THE AVOCADO IN SOUTHERN CALIFORNIA.

It may seem a strong statement to say that within the next quarter of a century the avocado will rank with the orange as a commercial fruit in Southern California. But there is a strong foundation of fact underlying this statement, and the reasons seem sufficient indeed to warrant the belief that it may become even more important.

First, the adaptability of the avocado to this climate has been proved beyond the possibility of a doubt. There are one hundred or more trees now in bearing, ranging in age from three to twenty-five years, scattered over the southern end of the State from the cool sea coast to the hot and dry interior. These trees embrace a number of widely different types, sizes and characters of fruits. This test of adaptability ought to be sufficient to satisfy the most sceptical.

Second, the food value of the fruit is the main basis for the above statement. It presents in a most easily digested and assimilated form as high as 12 to 18% of fat, which places the fruit in a class with the staple food products, instead of being a mere luxury as is the case with many fruits. The taste for the avocado is not always acquired upon first trial, but a few repetitions are usually sufficient to make any one extremely fond of it. The price is now prohibitive to most, and only a few have had opportunity to acquire the taste, but as the production becomes greater and the price lower, an almost unlimited demand will be created throughout the whole country. It is, of course, universally known as one of the most important staple fruits throughout the tropics and sub-tropics of the world.

Culture of the fruit in this country will be restricted to limited areas in Florida and Southern California, and consequently the danger of overproduction will be practically eliminated. As rapidly as price and production permit, the avocado will become an important and indispensable part of the daily food of the majority of the people of the United States.

PLANT SANITATION.

BOOK-NOTICE.

INSECTICIDES. BY H. MAXWELL-LEFROY, M.A., F.L.S., F.Z.S., Imperial Entomologist.

Office of Government Printer, Calcutta. Price 12 annas or 1s. 2d.

This useful circular is issued as 'Bulletin No. 23' of the Agricultural Research Institute, Pusa. Its sub-title is "Mixtures and Recipes for Use against Insects in the Field, the Orchard, the Garden and the House." The author expressly excludes the discussion of insecticides and methods employed against pests of plantation crops, as these have been dealt with elsewhere, but he describes succinctly the most approved remedies for the common pests of everyday life in the East. The bulletin is brief, but to the point. It consists of 22 pages and half as many well executed plates, the latter illustrating various forms and parts of spraying machines. The following selections from the sectional headings will give an idea of the comprehensiveness of the work:—"Insecticides on Field Crops," "Insecticides for Fruit Trees"; "Insecticides in the Garden"; "Soil Insecticides"; "Insecticides in the House" (treating of Clothes, Moths, Cockroaches, Fish-insects, Fleas and Mosquitoes), etc. From this it may be judged that Mr. Lefroy's little book should find a place in every household, and be on hand for ready reference.

A commendable feature of the work is that preference is given—in every case—to the simplest and least expensive remedies. Of the numerous proprietory insecticides that are constantly being launched upon the market, the author remarks that "not one of them is equal to the simple preparations here described, and we have yet to find any reliable 'patent' insecticide whose price and efficacy bring it within the range of the ordinary ones we use and recommend." The present writer can speak feelingly of the time wasted upon the testing of numerous samples (large and small), at the urgent request of the inventors or their agents, all of which owe their properties to some simple ingredient—usually soap or petroleum—which can be obtained for a fraction of the cost of the patent mixture. The author gives a catalogue of articles, to be purchased locally or made up from easily procurable ingredients, which will meet with nearly every requirement. The list includes:—

Lead Chromate, for biting insects on field crops:

Naphthalin Emulsion, for the vegetable garden:

Crude Oil Emulsion, for sucking insects:

Book Solution, for the preservation of bindings:

Pyrethrum Powder, for vermin:

and such simple ingredients as Rosin, Soda, Sanitary Fluid or Phenyl, Arsenic, Citronella Oil, Copper Sulphate, Lime, Borax, Naphthalin, and Soap.

Lead Chromate is an insecticide introduced by Mr. Lefroy to take the place of the better known but more dangerous arsenical compounds. After exhaustive tests he pronounces it to be a perfect substitute for arsenical poisons. Its conspicuous yellow colour makes it easily seen on the plants and is a safeguard against accident.

Naphthalin emulsion is, I believe, a novelty. It has been evolved to meet the need for a rapid but evanescent insecticide, and is employed more especially for such vegetables as "well-formed cabbages or lettuce which will soon be cut." It is described as "an insecticide that should be in every garden, as it is extremely effective for a short time and leaves no trace on the plant by next day." The formula for the preparation of the emulsion is as follows:—"Dissolve 6 oz. concentrated size in ½ gallon of hot water, and add 1 lb. soft soap. Dissolve, in two gallons of kerosene as much naphthalin as it will absorb; at ordinary temperatures about 2 lbs. 12 oz. is taken up; by warming carefully in the open over a small fire, 8 lbs. of napthalin will dissolve. Add the napthalin solution to the hot size-soap solution, add ½ gallon of water and churn or agitate with a syringe or sprayer."

Crude Oil Emulsion is employed as the stock contact poison against sucking insects (Scale-bugs, Aphides, etc.), but—according to the author—may be replaced to advantage by 'Virmisapon'—an insecticide made locally in accordance with Mr. Lefroy's suggestions and advice, and placed on the Indian market to supply the demand for a cheap and effective ready-made remedy.

The author draws attention to the use of deterrents, where the employment of an actual insecticide is impracticable or inadvisable. The object of a 'deterrent' is to render the plant unpalatable. It may be of considerable service in preventing the spread of a localized

pest. This principle may be applied to tea cultivation; for instance, where a small area of tea is infested by a swarm of caterpillars, the pest may often be isolated and the surrounding busbes protected by spraying the latter with a deterrent—of which the well-known fungicide 'Bordeaux Mixture' is perhaps the most effective and convenient. I believe it is a fact that Bordeaux Mixture first came into use as a deterrent pure and simple. It was employed to spray grapes growing along the roadsides in the vineyards of Bordeaux; to prevent petty thefts of the fruit. It was subsequently observed that these roadside plants remained markedly immune to fungus pests that prevailed in other parts of the vineyards, so leading to the discovery of its fungicidal properties.

Amongst insect pests of the house, Mr. Lefroy alludes to the annoying habit of certain wasps that amuse themselves by plugging key holes with their mud cells. He recommends the device suggested by a correspondent, which is described in his own words:—"My bungalow seemed to be the rendezvous of all the bees, wasps and stinging flies of the station. Prominent amongst these creatures was one robed in a kind of metallic blue and with a figure like a hubble-bubble; this waspish lady would go round the bungalow daily and block up all the key-holes in my furniture, no matter how often I cleared these out, Mrs. Wasp would block them up again and put a white seal on them to let me know that it was she who did this. Things got so bad that I tried an experiment, which for the last twenty years has proved most successful. I simply cut a small block of wood, 8″ × 4″ × 3″, and in this I bored 2 dozen holes 2½″ deep by ½″ diameter. In each of these holes I put an empty Carter's Little Liver Pill bottle and hung the block of wood on a nail on the wall just in front of my writing table where I can see it. Result: for twenty years the key-holes of my furniture have never once been blocked. For twenty years, in spite of my being transferred from and to different stations, my two dozen bottles have had tenants; sometimes it is bees, sometimes wasps; they arrive, look over the establishment, select an empty compartment, stock it with provisions, which are sometimes small spiders, sometimes caterpillars, as the case may be, seal up the bottle and leave nature to do the rest."

Borax, either dusted into corners, or mixed with syrup and smeared on pieces of tin, is recommended as an infallible cure for Cockroaches; and there is a useful recipe for a mixture to preserve the covers of books from the ravages of the same objectionable insect. I may mention that this mixture has been in use for some years in the library of the Royal Botanic Gardens, where it has proved itself a most efficient deterrent.

The author has prescribed for nearly all the petty plagues of daily experience, but there are two notable exceptions. He does not touch upon the important question of the prevention of the abominable house fly—now recognized as one of the principal conveyers of the germs of Typhoid and many other serious intestinal diseases. Nor does he give us any suggestions for the mitigation of the recurrent plague of 'eye-flies.'

Tape soaked in a saturated solution of Corrosive Sublimate is recommended as an efficient barrier against the passage of ants. We are told that it "tacked or tied round legs of tables, along edges of shelves, etc., ants will not cross it." This may be effective against certain species, but it has proved absolutely useless against a tiny ant that infests my laboratory. They will cross the medicated tape without hesitation and—apparently—with impunity. I have seen a procession of this particular species traverse a freshly laid trail of the solution almost before it was dry.

Nor have I been more successful, after repeated experiment, with the ingenious mosquito trap devised by Mr. Lefroy and described in this bulletin. I have followed the printed instructions to the letter, but not one single mosquito have I yet succeeded in inveigling into the trap, though they have indicated their presence in their usual irritating manner.

I have, however, no hesitation in recommending Mr. Lefroy's booklet as an indispensable adjunct to every household.

E. Ernest Green.

AGRICULTURAL FINANCE AND CO-OPERATION.

INDIAN ADVOCACY OF CO-OPERATIVE CREDIT.

(From the *Indian Agriculturist*, Vol. XXXVI., March 1, 1911, No. 3.)

The admirable speech delivered by Mr. Saroda Charan Mitter at the Midnapore Co-operative Conference is noteworthy for several reasons. This is the first occasion on which an Indian leader of eminence has identified himself whole-heartedly with the co-operative movement. What has caused the indifference which has hitherto prevailed among the educated classes in regard to so beneficent a reform has not yet been explained. But it is a melancholy fact that Indian journals have either ignored the Co-operative Credit Societies, or have damned them with faint praise, and that the abundant oratory of the period since the movement began contains scarcely a reference to institutions which, if adequately supported, are destined to work a mighty change in Indian Agriculture and industries. Mr. Saroda Charan Mitter's address marks, we hope, the beginning of a new epoch in which public men in this country will recognise the great possibilities of co-operation and exert all their influence in its favour. Not only, however, was the speech a pioneer deliverance, but it was a very careful and sagacious statement of the conditions which render a system of Co-operative Credit so thoroughly suitable to the peculiar needs of India. Mr. Mitter was not content to give the movement his blessing in a series of platitudes which are easy to string together, but which give neither light nor leading. He has set out plainly the complete problem which has to be solved, and seldom has the pitiable indebtedness of the Indian Agriculturist been more clearly described and analysed. The first conclusion which emerges from a study of the facts is that no mere personal benevolence on the part of the landowner, or any philanthropist will be of real assistance to the ryot. "My own experience," says Mr. Mitter, "in money-lending to cultivators in a small scale has shown the utter futility of a low rate of interest." We may add that thistestimony can be supported by many who have made a similiar experiment. The explanation is that the indebted classes among the cultivators are so far demoralised by their chronic insolvency that facilities for obtaining money at a cheap rate are merely inducements to fresh extravagance. This proposition is true in regard to the agricultural population of every European country, and involves no special discredit to the Indian cultivators. The lesson to be learned is, in the words of Sir F. A. Nicholson, that "it is useless, however amiable, to believe that the ryot is only thirsting for capital in order to invest it at once in the improvement and development of his estate; that the influx of cheap capital is all that is wanted to enable him to wipe off his old debts in order to start forthwith on self-denying career of productivity." Something other than cheap money is needed. The peasant requires to be brought into an organisation in which he can obtain credit under restrictions that will stimulate not to incur. As Mr. Saroda Charan Mitter puts the case, "without checks against improvidence and waste, without moral and social safeguards against disproportionate marriage and funeral expenses, against luxuries in imitation of the costumes and manners of the fashionable world, and without the acquisition of the habit of thrift, we cannot expect improvement in the economic condition of the people." It is as a means of supplying these checks and safeguards that the Co-operative Credit Society is invaluable. In a society of this kind a ryot obtains a loan on the security of the unlimited liability of all its members, and, if they realise their position, they will be careful to see that he is a trustworthy person, and to use their influence not in favour of extravagant expenses on his part but against them. It is easy to see that an institution conducted on these lines is a school of thrift and a powerful promoter of social reform. But it is equally evident that, without the guidance of someone who understands the principles of co-operation, and who possesses some standing in the community, the illiterate masses are not in a position to save themselves. Under strong leadership they can make a fight against customary extravagance and gradually work their way out of indebtedness, but if they are left to themselves social pressure will be irresistible. Hence it is that the Co-operative Credit movement calls for the assistance of educated men who feel concern for the welfare of the masses. Officials can provede the framework of an organisation and help by their supervision. But the guidance of individual societies is a work which they cannot undertake, and in which their intervention would be detrimental. Mr. Saroda Charan Mitter truly says that "in the operation of the principles

of self-help the less of official assistance and intervention the better. The desire and active steps for national improvement must come from within to be most effective. Holding this view, he appeals to the educated classes for their assistance. The various Governments have frequently made this appeal in vain. But now that it comes from a leading member of the educated classes, whose distinguished legal career is a sufficient guarantee that the reform which he advocates is genuine and practicable, we may surely accept that there will be a wide and efficient response. Without the help of the educated there is little hope that the masses can ever be delivered from the grip of usury. What outlook has any industry which is financed by money-lenders who have only a small capital, and who are compelled to insure themselves against loss by charging heavy rates of interest? Unfortunately exorbitant usury is not the only drawback of this system. So completely are the ryots in the hand of the *mahajans*, that in some industries the usurers can control absolutely the price which the cultivators receive for their produce. The ryots are thus hemmed in without a chance of escape. Only co-operative credit can deliver them, and Mr. Saroda Charan Mitter has rendered a great service by impressing this fact upon the educated community.

CO-OPERATIVE CREDIT.

(From the *Indian Agriculturist*, Vol. XXXVI., No. 3, March 1, 1911.)

Steady Progress Made.

A Government Resolution passed on the annual report on the working of co-operative credit societies in the Bombay Presidency, including Sind, for the year 1909-10, was issued in Thursday's *Government Gazette.* It runs:—The report, which covers a period of nine months only, shows that steady progress continues to be made in the Presidency proper in establishing new co-operative credit societies and in developing those already in existence. It records a net increase of 39 societies, bringing the total number up to 208. Notable progress was again made in the Northern Division where 21 of the new societies are located, and Government are gratified to observe that there is now at least one society in every district of the Presidency proper. Out of the 208 registered societies 185 are in actual working operation, an increase of 59 over the previous year. The statistics show that the movement is gaining in strength in other respects. Thus the average membership of urban societies, including the "Centrals," has increased from 80 to 101, and of rurals from 59 to 65, while the average reserve fund has risen from Rs.156 to Rs.225 in the one case, and from Rs.151 to Rs.177 in the other. The total working capital of all classes of societies has increased from Rs.5,62,456 to Rs.8,28,816, and the growth of co-operative credit, if slow, is illustrated by the increased attraction of outside capital which constituted 8 per cent. of the total as against 6 per cent. last year, while the proportion in the shape of loans from Government fell from 22 to 20 per cent. Urban societies continue to show most success in raising capital from outside sources, and at the close of the year 12 per cent. of their working capital was of this class. In the case of rural societies the percentage of outside rose from less than 3 to a little over 4.

Statisfactory Feature.

Pending the institution of a Central Bank, supported by a Government guarantee, the scheme of which has not yet been finally approved, the societies have to depend on a very casual and restricted supply of outside capital, but in this connection the growth of the "Central" societies which lent Rs. 48,000 during the year to 30 societies is a very satisfactory feature of development. Generally, societies are becoming more highly organised as well as advancing in numbers, membership and funds. This is indicated, among other things, by the increasing interest and importance of the annual reports of individual societies, the development of branch societies, the growth of current account and the beginnings of private audit and of society libraries. The great number of Conferences and their proved usefulness are evidence of the intelligent enthusiasm which has been aroused in the participators in the movement. So far there has been no failure of a kind to cause even a local set-back. During the year under report one society only worked at a trifling loss, while on the other hand there is found such an example of conspicuous success as the Southern Maratha Society with a membership of nearly 1,400 and a working capital approaching 1½ lakhs.

Of special societies those in connection with the weaving and leather making industries are now receiving special attention. There are at present six societies for weavers, as against four at the end of the previous year, together

with a weaving institute at Betgeri-Gadag. It was anticipated that progress in strengthening the economic position of the weavers by including them to co-operate would be slow, and important results could not be expected for some time to come. Government will continue to watch closely the progress made. The increase from 7 to 10 in the number of leather workers' societies is satisfactory in view of the recommendation subsequently made by Mr. Guthrie, on whose special survey of the industry Government have recently issued orders that the local leather workers should be helped wherever possible by the formation of co-operative credit societies.

Grain Banks.

The Registrar has given some interesting details regarding grain banks, in which it appears that little progress has been made. The matter is one which should continue to receive attention and to be dealt with in the annual report.

During the year the amount loaned for redemption of old debts was Rs. 40,000 or 8 per cent. of the total amount given out on loans to members. These are double the previous year's figures, but represent an insignificant contribution to the solution of a vast practical problem. No widespread improvement can be expected until societies are much more numerous than at present and have the support of a Central Bank. In the meantime it is most gratifying to observe the success obtained in Mandvi Taluka which has proved an unexpectedly favourable field for work in this direction.

The single registered society in Sind continued to extend in resources and activity, and has succeeded in attracting money from local capitalists. With the registration of two more societies since the close of the year and the contemplated establishment of two or three more, it would seem that the co-operative movement is at length likely to make some progress in the province.

MIDNAPORE CO-OPERATIVE CONFERENCE.

(From the *Indian Agriculturist,* Vol. XXXVI., No. 3, March 1, 1911.)

Mr. Saroda Charan Mitter's Views.

The Midnapore District Co-operative Credit Conference began on the afternoon of January 29. There was a large attendance of local and non-official delegates, and Messrs. Buchan, Registrar, and J, Mitra, Assistant Registrar, Co-operative Credit Societies, Bengal, were also present. Mr. W. A. Marr, C. S., Collector of the District opened the proceedings and congratulated the promoters on their success, and gave his experience of what he had seen in the interior of the district.

Mr. Saroda Charan Mitter was elected President. He said :—

We have met here to compare the amount of work done and progress made during the last year by each of the Co-operative Credit Societies in the district, to provide for the maintenance of uniformity in their working, and for raising their general level by common counsel. The object of this Conference is, therefore, very important, and your deliberations ought to be useful, not only as a means of giving impetus to the material progress of the district, but also of other districts in Bengal. Midnapore has, as it appears from your reports, done excellent work under the fostering care of the Registrar and Assistant Registrar of Co-operative Credit Societies in Bengal and of public-spirited volunteers, and it ought to be a type for other districts to follow. The village communities so useful at one stage of civilisation did very good work, and now they have died a natural death. The new stage of things requires an organisation of a different kind and of a wider scope. The ideas that dominated village units in days gone by have ceased to have vitality, and new ideas of brotherhood must replace them, working in a new groove.

Indebtedness of Artisans.

In a country mainly agricultural, as India is, the economic problem most difficult of solution is : How to remove the general indebtedness of the artisans and the agricultural population. Their poverty is well known and its causes are various, although it is generally ascribed to the conduct of usurious money-lenders; but the present condition of India is not without a parallel in the history of other countries. How did the masses in these countries, heavily burdened with debt, save themselves from the condition of perpetual pauperism and became prosperous artisans and peasants, the pride of their respective countries? The usury laws could do them no good—these laws were evaded with impunity. The repeal of the usury laws gave freedom of contract and tended to remove deceit and dishonesty ; but it was not expected that the repeal would better the pecuniary condition of the borrowers. The repeal brought in India worse evils, as I have repeatedly pointed

out. The Deccan Agriculturist Relief Act with its rules against usurious rates of interest has not, however, done much good to the Bombay Presidency. The rules of equity against unconscionable bargains have not also in other Presidencies done much in the way of relief against mahajans and sowcars. Advances from Government treasuries in the shape of taccavi have not only failed to relieve distress, but they had in many instances a positive demoralising effect. The Public Loan offices started in the different districts are not much better than mahajans so far as the industrial and agricultural populations are concerned. Their demoralising has continued uninterrupted.

The history of the economic progress of Germany, Austria and Italy demonstrates the futulity of ordinary banks or Government advances in improving the condition of the masses by relieving them from permanent indebtedness. If a mere low rate of interest were a sufficient basis of improvement in the condition of the ryots in any country, philanthropic advances would have been of considerable benefit; but experience has shown that such advances have generally a demoralising effect. My own experience in money-lending to cultivators on a small scale has shown in the utter futility of a low rate of interest. Causes other than usurious rates of interest are at work in the cases of uneducated and reckless people. In many cases the mere facility in obtaining loans at low rates of interest has a degenerating influence on the debtors. Without check against improvidence and waste, without moral and social safeguards against disproportionate marriage and funeral expenses, against luxuries in imitation of the costumes and manners of the fashionable world, and without acquisition of the habit of thrift, we cannot expect improvement in the economic condition of a people. If each member of the society is security for the debts of the other members, the liability being unlimited, he would not, on the death of a parent of one of them, incite extravagant expenses by borrowing; he would, on the other hand, check waste of money by his neighbour, for his own sake, if not for the sake of his neighbour himself. Thus each would be a check string of the other members of the society. There must be means of creating habits of economy and of improving morality before we can expect permanent good of not only the agricultural classes but also of the industrial population.

Caste and Sociology.

It has been said that the caste system divided the Hindu population into water-tight compartments, and it is sometimes thought that caste prejudices constitute a insuperable bar to the formation of People's Banks on co-operative principles. The evils of the caste system have been overstated by social reformers fond of the European social system; but as a matter of fact, social relations between the different castes in rural areas were very friendly, and associations, except as to inter-marriage and inter-dining were never prohibited. Persons of different castes mixed freely with each other, and no difference attended business relations merely on account of caste. But with the advanced culture of the higher classes and the unchanged primitive intellectual conditions of the masses, the friendly relations between the higher and lower caste is fast disappearing. The age of a person, whatever his caste is, commanded respect, and he would be addressed as an elder brother or a paternal uncle or grand-uncle by even a person of a superior caste, but the old feeling of respect, of brotherhood, and equality and of affection is not now as apparent as one would wish. If the old state of feelings had lasted with the advance of psychological ideas of equality and brotherhood of men and with apparent but not real social progress, the caste system would not have been considered an unmixed social evil. With, however, the advance of present intellectual and sociological ideas and the existence of the caste system, which has taken too deep a root in Indian soil to be easily removed, some time of unity besides the old village community system is necessary to unite apparently discordant units. Petty quarrels and jealousy giving rise to faction and leading to ruinous litigation ought to abate if the solidarity of the people be desirable. Co-operative Banks and co-operative sales and purchases may afford a common platform for better and more friendly understanding of each other's interests. India in its present state is best suited for the success of the operation of co-operative principles, and in the words of Mr. Henny Wolff, the greatest English authority on co-operative credit principles:—"Of all countries, in the old world and the new, there seems none so specially marked out for the practice of co-operative credit as India." The success also has been, according to the same authority, phenomenal. But the decay of commercial ideas in village units, added to

the unabated rigidity of caste prejudices, require rapid extension of co-operative credit principles and practice, not only for the benefit of the agricultural populations, but the sociological advance of all classes, not excepting the depressed classes of Hindus. Each village, if sufficiently large, and each group of small villages throughout the length and breadth of India should have a People's Credit Society with a Central People's Bank for each group of such societies.

CREDIT SOCIETIES AND NATIONAL ADVANCEMENT.

Who, however, are to take active interest in the formation of other Co-operative Credit Societies? The masses in all parts of the country are ignorant and illiterate, and sufficient efforts are not being made to spread education among them. The index of national progress and national prosperity is improved agriculture and industry, and a thriving peasantry is an essential element of progress. The general public, especially the higher and literate classes, are deeply interested in national advancement. Philanthropists and public-spirited men should, with all earnestness, come forward to reform the agricultural and labouring classes, to elevate their social and moral status and lead them in the ways of improvement. Thus only will they effectually minister to the solid and permanent welfare of India. The present situation is highly depressing; and although the extension of Co-operative Credit Societies may be the panacea for all evils, it must be admitted to be one of the most powerful agents for national improvement. The progress already made in the establishment of People's Banks and Co-operative Societies is mainly due to volunteer work, but the educated classes must more largely interest themselves in the extension of the principles of co-operation and self-help. Much has been done by the Registrars of Co-operative Societies and their able assistants. Our hearty thanks are due to my friends, Messrs. Gourlay, Buchan and J. Mitra in Bengal, and Mr. K. C. De in Eastern Bengal and Assam, and we expect greater as well as continuous help from them and their successors (changes are so constant in the service). The chief executive officers of the districts also deserve our warmest thanks for the interest they have always evinced, but more volunteer work from Indians themselves is absolutely needed. In the operation of principles of self-help, the less of official assistance and intervention, the better. The desire and active step for national improvement must come from within to be most effective. I earnestly request my educated Indian brothers to come forward as a "salvation army" for forming more associations for co-operative credit and self-help. "It is self-help," said the great William Gladstone, "which makes the man, and man making is the aim which the Almighty has everywhere impressed upon creation." We must train the people to trust each other and train them to be thrifty. "It is thrift by which self-help for the masses dependent upon labour is principally made effective. In them thrift is the symbol and the instrument of independence and liberty, indispensable conditions of permanent good." The educated classes must work to create habits of self-help and thrift in them and feelings of mutual confidence and trust and mutual help.

Credit Societies, however, should be cautiously extended. The present Act of the India Council of 1904 is restrictive, but it has borne abundant fruit. The Act now requires amendment, as the time has come for rapid expansion of Co-operative Banks; but the people require preliminary education, and they should be made to understand their use before they became a society. I am always afraid of beginning with a flash, because a flash generally ends in smoke. I wish to be sure. I wish to have solid foundtion, notwithstanding that we may be slow. Volunteer workers should always be careful, and the principles of co-operative credit as enunciated by great masters of this department of political economy, Schulze, Delittzsch, Raiffeisen, and Wolff, should always be kept in view. Small beginnings in each district will serve as sufficient lessons.

THE INCUBUS OF USURIOUS INTEREST.

The initial difficulty in the formation of associations is the almost inextricable indebtedness of those very persons to relieve whom should be its first endeavour. The incubus of debt, consisting mainly of usurious interest and compound interest which swell the burden in geometrical progression, is not unfrequently too heavy to remove, and persons with such burdens on them are generally the most troublesome members. The greatest caution is necessary in dealing with persons who are practically the slaves of mahajans. The money-lender is generally a Shylock, and mercy is a rare element in his mental constitution. The present India Act for the relief of insolvent debtors is not available to those whose debts are less than Rs.500, and very few of the ryots or labourers can obtain protection under the Act,

There is also no provision in the regulation districts of Bengal, like those in the Sonthal Paragannas or the Chota Nagpore Division for reduction of debts. For the greater expansion and successful practice of co-operative principles, we may fairly ask the Government to legislate on these matters. Until, however, the Legislature intervenes, the formation of fresh associations should be undertaken only where poverty may be relieved with substantial loss of more solvent members.

One word more. If co-operative credit societies have to meet all the requirements of the agricultural or the labouring population and become sources of national benefit, they must not be left to act each one wholly by itself. The principle of co-operation should extend from individuals to societies. There should be concerted and united action, and common counsel and common control are essential features. Mutual assistance would necessarily follow common business; continued action among credit societies requiring the formation of unions and central banks, and at present there are a few unions in Bengal. With the increase of societies unions should also increase.

NEED OF MUTUAL CO-OPERATION.

The principles and practices of economic co-operation may be extended from credit and banking to stores, sales, and purchases. When Raiffeisen first declared war in Germany against usury, he started a co-operative bakery. For the small fund he had to face much difficulty. When, however, it became a success, the principle was rapidly extended to purchase and other industries. "At the present time not a day passes in Germany without notices coming of the establishment of one, two or more societies." The practice is not new to India which has reached a high stage of civilisation, but stimulus to revise and introduction of advanced economic principles are needed. The introduction of improved elements of tillage and irrigation, the cultivation of new crops, and the importation of better seeds require mutual co-operation.

The situation of our cultivators with respect to grain dealers or aratdars, who are also money-lenders, is so highly depressing, that to move in a better groove is practically impossible. I have noticed a curious fact at the Sheoraphuli Hat, which is a large and important market on the river side in the district of Hooghly. That market commands the price of potato, and potato-buyers are mostly East Bengal mahajans who have formed a clique. The aratdars sell oil-cakes and other commodities on credit, and necessarily at exorbitant prices to the producers, and when the latter bring their produce (potato or jute) to the market, they have to place their bags in charge of their respective aratdars. The mahajans and aratdars are either the same or have mutual obligations, and as soon as the bags are stalled they are weighed and sent by boat at once to jute mills or to Calcutta. This is done in the morning, and in the afternoon the mahajans and aratdars hold a meeting and they fix the price of the commodities. The producers have no voice and have to accept what price the aratdars and mahajans have agreed to. The prices are not fixed on economic principles of demand and supply, but quite arbitrarily. The prices often abnormally vary from Calcutta or jute mill prices. The number of intermediaries between the producer and the consumers are too many to the loss of both. Co-operative sale with the help of co-operative credit banks would in all probability extricate the producers from the clutches of mahajans and aratdars. I have carefully read the proceedings of your last Conference, and I congratulate you for the good work you have done in this important department of economic progress. Your banks, urban and rural, showed successful working. The gradual development has been steady and affords indication of prosperity in the near future. Yours is a mainly agricultural district, and so far as a stranger may see, it compares favourably with most of the adjoining districts. You have a fertile field for the successful practice of comparative principles by establishment in sufficient numbers of people's banks, co-operative stores, societies for co-operative purchases and sales and of unions and central banks.

MISCELLANEOUS.

PERADENIYA EXPERIMENT STATION.

Minutes of a meeting of the Committee of Agricultural Experiments held at the Experiment Station, Peradeniya, on 7th September, 1911.

Present:—The Director, R. B. Gardens, the Hon'ble the Government Agent, C.P., the Assistant Director, the Government Entomologist, Messrs. H. F. Laycock, H. Inglis, and the Secretary.

Resolved:—

(1) That the figures of the soil wash plots to date be not published.

(2) That an experiment *re* the cost of decorticating rubber seed be carried out.

(3) That steps be taken to ascertain the cost of a decorticating machine.

(4) That members of the Committe be requested to be more expeditious in the passing on of Circular Notices.

(5) That Messrs. Beachcroft and Tisdall be approached as to their willingness to act on the Committee *vice* Messrs. Turner and Anderson resigned.

J. A. HOLMES,
Secretary C. A. E., and
Superintendent, E. S. P.

Peradeniya, 9th September, 1911.

PROGRESS REPORT ON EXPERIMENT STATION, FROM 13TH JULY TO 7TH SEPTEMBER, 1911.

TEA.—All the recently pruned plots are now in bearing.

The Manipuri Indigenous is still yielding heavily; the 5 acres which have now been running for 2 years having given 2,108 lbs. of green leaf in August.

CACAO.—Canker has been very prevalent along the river; cutting and two sprayings have been carried out at a cost of Rs.1·02 per acre for spraying, and canker Rs.1·27.

There is at present the promise of a very fair crop.

COCONUTS.—The coconut experiments are being continued, 30 gallons of oil being extracted in July.

RUBBER.—*Para*. A large quantity of seed has been gathered for the purpose of making oil; the cost is something under ½ a cent a pound; the weight of 1,000 seeds was found to be 7 lbs.

Ceara and Dichotoma are being tapped, but the yields are indifferent.

Funtumia is seeding for the first time.

PADDY.—The paddy field is being prepared for the current crop; some delay was experienced owing to the prevalence of fever amongst the Sinhalese.

GREEN MANURES.—The following green manures have been cut yielding as below for 1/100 of an acre:—

Plant.			Yield.
Leucæna glauca	...	...	164 lbs.
Tephrosia candida	...	...	184 ,,
do Hookeriana	...	...	88 ,,
Cajanus indicus	...	...	170 ,,

The plot of *Cassia mimisoides* was tipped, as if cut low it dries.

OIL GRASSES.—*Cymbopogon polyneuros* has been distilled, the oil being destined for the Imperial Institute.

GENERAL.—Ploughing and the removal of stumps is being carried on in the cleared cacao land.

The barbed wire fence has now been completed round the inside boundary.

Half an acre of castor has been sown to obtain a supply of seed.

DEDIGAMA MARKET SHOW.

19th August, 1911.

A series of market shows, which are becoming such popular institutioons, were arranged by the Assistant Government Agent of Kegalla, but it was feared that they would have to be abandoned owing to the unusual drought that prevailed during the early part of the year, and to the severe outbreak of fever in the District. The first of these, however, came off at Dedigama, in Beligal Korale, on the 19th August, and, judging from results, the success of this Show was an ample reward for the trouble taken over it. Some time before the Show a quantity of selected vegetable seeds were distributed free of cost among *bona fide* village cultivators.

The Show was held in the Gansabawa Court at Dedigama, and was opened by the Assistant Government Agent, who also distributed the awards, which were all in cash,

The Ratemahatmaya of the Division, the Kachcheri Mudaliyar and a large number of headmen were present throughout the proceedings. The attendance of villagers was not as large as it ought to have been, but this is probably due to the prevalence of sickness as well

as, to some extent, to the novelty of the Show which was the first of its kind to be held in the Korale.

Vegetables.—The collection of vegetables representing all sections in the Catalogue was satisfactory, especially the pumpkins, cucumbers, brinjals, capsicums, beans and gourds.

Fruits.—This class was rather poor, as the season for fruit was a bad one, but the oranges, heennarams, plantains and limes were good.

Miscellaneous.—There were several sections under this class, all of which were well represented. Coconut, Coconut Oil, Copra, Betel, Sugarcane, Cassava, Paddy and Dry Grains deserve mention.

In the Industrial class were exhibited pots and pans, bricks and tiles, iron work, rattan baskets, excellent specimens of brass work, skilfully woven mats, lace and native Agricultural implements.

School Garden Exhibits made a brave Show. Weragala came first with a fine lot of pineapples, guava, onion, and varieties of vegetables, as well as flowers. Kotapola was second best.

The Dedigama Girls' School also sent a collection of School Garden products and was awarded a prize.

At the termination of the Show a sale was held, with the assistance of the Kachcheri Mudaliyar and the Ratemahatmaya. Some of the exhibits fetched good prices.

N. WICKREMARATNE,
Agricultural Instructor.

A DICTIONARY OF TERMS USED IN AGRICULTURE, BOTANY, CHEMISTRY, AND ALLIED SCIENCES:

FOR THE USE OF PLANTERS AND OTHERS.

BY J. C. WILLIS AND M. WILLIS.

(*Continued from page 261.*)

Biometry ... Systematic measurement of living things for the study of variation
Bipinnate ... Twice pinnate
Bird pepper ... Capsicum minimum
Birth wort ... Aristolochia
Biscuit ... A dried circular sheet of rubber
Biseriate ... In two rows
Bisexual ... Containing both sexes
Bissy nuts ... Cola nuts
Bitch Wood (W. Ind.) ... Lonchocarpus
Bitter ash (W. Ind.) ... Picræna excelsa
Bitter oil ... Calophyllum Inophyllum
Bitter orange ... Seville orange
Bitter wood (W. Ind.) ... Picramna, Simaruba, Trichilia, Xylopia
Bivoltine ... Producing two generations a year
Black beadshrub (W. Ind.) ... Pithecolobium Unguis-cati
Blackberry ... Rubus
Black boy ... Xanthorrhea hastilis
Black butt ... Eucalyptus pilularis, etc.
Black Cumin ... Nigella sativa
Black dammar ... Canarium
Black gram ... Phaseolus Mungo, var. radiatus
Black grub ... Cutworm
Black wattle ... Acacia decurrens
Black wood ... Acacia melanoxylon; Dalbergia latifolia
Bladder wort ... Utricularia
Bleeding ... Running of latex or sap from a wound
Bleeding heart (W. Ind.) ... Colocasia antiquorum
Blimbi, Blimbing ... Averrhoa Bilimbi
Blinding tree ... Excoecaria Agallocha
Blister blight (tea) Exobasidium vexans
Blood berry (Rivina) ... Rivina humilis
Blood flower (W. Ind.) ... Asclepias curassavica
Blood meal ... Dried and powdered blood
Blood wood ... Eucalyptus corymbosa
Blood wood (W. Ind.) ... Laplacea
Blood wood (W. Ind.) ... Lagerstrœmia Flos-Reginæ
Blood wood (Jamaica) ..Gordonia, Hæmatoxylon
Blue bell ... Campanula rotundifolia
Blue gum ... Eucalyptus Globulus
Blue stone ... Copper sulphate
Blue vitriol ... do.
Bo ... Ficus religiosa
Body (tea) ... Capacity for making much tea (liquid) with little solid.
Boga or bogga medeloa ... Tephrosia candida
Bois fidele ... Fiddle-wood, Citharexylum
Bois immortelle... Erythrina umbrosa
Bold (of Cacao beans) ... Fully grown and well developed
Bole ... Straight main trunk

Boll ... Pod of cotton
Boll-worm ... Caterpillars tunnelling into cotton bolls
Bombay-aloe ... Agave
,, -hemp ... Crotalaria, Agave
Bone meal ... Crushed and powdered bones
Bor (Ind.) ... Ficus Elastica
Bordeaux Mix- ture ... A mixture for spraying made up of water 50 gallons, Copper sulphate 6 lbs., Lime 4 lbs.
Borneo camphor.. Dryobalanops aromatica
Borneo rubber ... Willughbeia
Boro ... Rice-crop reaped in spring (Bengal)
Botryose ... Racemose
Bottle-brush ... Callistemon
Bottle gourd ... Lagenaria
Bottle tree ... Baobab
Brab (Ind.) ... Palmyra palm
Bracelet wood ... Jacquinia armillaris
Bracken ... Pteris Aquilina
Bract ... The leaf in whose axil a flower arises
Bracteate ... With bracts
Bracteiform ... Bract-like
Bracteole ... A leaf on the flower-stalk, between bract and flower
Bractlet ... Bracteole
Brake ... Bracken
Bran ... The outer skin of the grain of wheat, &c.
Brazil cherry ... Eugenia Michelii, etc.
Brazil nut ... Bertholletia Excelsa
Brazil wood ...Caesalpinia sappan, etc.
Brazilian arrow- root ... Manihot utilissima
Brazilian nutmeg Cryptocarya moschata
Breadfruit ... Artocarpus incisa
Breadfruit, Nico- bar ... Pandanus Leram
Bread nut ... Brosimum Alicastrum
Break ... A lot of tea made at the same time
Brick tea ... Tea compressed into bricks, for sale in Tibet, Russia, &c.
Brinjal, egg- fruit ... Solanum Melongena
Broad bean ... Vicia Faba
Broadcast (sow- ing) ... By hand
Brocole ... A variety of cabbage, Brassica oleracea
Broodiness ... Desire to sit
Brown blight ... A fungus disease of tea leaves
n bug ... Lecanium hemisphericum
Budding ... Inserting a bud at a cut made in the bark of a stem, so as to cause it to grow there
Bud rot ... A fungus disease of coconut palm buds
Bud scale ... A leaf in outer part of a bud, reduced to a scale
Buffalo ... Bos Bubalus
Bulb ... A short stout shoot, made up of swollen leaves (*e.g.*, onion)
Bulbil ... A little bulb
Bullate ... Puckered
Bulk ... To mix together, to cause uniformity
Bulrush Millet ... Pennisetum typhoideum
Bullock's heart ... Anona reticulata
Bully tree ... Bumelia nigra
Bund ... An earthwork embankment
Bundle sheath ... A layer of hard tissue surrounding a vascular bundle in a stem
Burmese varnish tree ... Melanorrhœa usitata
Burn nose ... (Jamaica) Daphne tinifolia
Burr ... A fruit with densely prickly outside
Butter cup ... Ranunculus
Butter tree ... Bassia or Pentadesma butyracea
By-product ... A product incidentally made in the manufacture of something else
Cabbage ... Brassica oleracea
Cabbage (coconut) The bud at tip of stem
Cabbage palm ... Oreodoxa oleracea
Cacao ... Theobroma Cacao
Cacoon (W. India) Entada scandens
Cactus ... A fleshy plant, belonging to the order Cactaceæ
Cadena de Amor (Phil. Is.) Antigonum Leptopus
Caducous ... Falling early
Cadjan ... A woven coconut leaf, used as a water-shedding covering
Caffein ... The alkaloid of coffee
Caingin ... Chena
Cake ... The refuse after crushing oil out of seed
Calabacillo ... A variety of cacao
Calabar-bean ... Physostigma venenosum
Calabash Tree ... Crescentia Cujete
Calabash cucum- ber ... Lagenaria vulgaris
Calambach wood.. Aquilaria Agallocha

Calcareous	... Chalky
Calisaya	... A species of Cinchona
Callus	... A hardening, produced round a wound
Caltrops	... Tribulus terrestris
Calumba	... Jateorrhiza palmata; (false) Coscinium fenestratum
Calyptrate	... With a detachable cap
Calyptriform	... Cap-formed
Calyx	... The outer, usually green, of the two envelopes of leaves round a flower
Calyx tube	... The coherent part of the calyx
Cambium	... The growing layer in a stem, which makes new wood within, new bark without
Camote (Phil. Is.)	Sweet potato
Campanulate	... Bell-shaped
Camphor	... An aromatic substance, produced from Cinnamomum Camphora, &c.
Campong	... A garden or compound
Campylotropous	Bent ino a U shape
Cancellate	... Latticed.
Candle-nut	... Aleurites triloba
Candle-tree	... Parmentiera cerifera
Candy	... 500 lbs.
Cane-sugar	... Saccharum officinarum
Canella-bark	... Canella alba
Canker	... Any disease causing an appearance like decay on the surface
Cannon-ball tree	Couroupita guianensis
Cantaloupe	... Melon
Caoutchouc	... India-rubber
Cape goosberry	Physalis peruviana
Caper	... Bud of capparis spinosa
Capillarity	... Movement of fluid through minute (hairlike) openings, in soil etc.
Capillary	... Hair-like
Capillary attraction	... Attraction of substances at very close range, when moisture comes between
Capitate	... Head-like
Capitellate	... Diminutive of the last
Capitulum	.. Head of flowers
Caprification	... Pollination of the fig
Capsule	... A dry, opening fruit of several carpels
Carabao (Phil. Is.)	Buffalo
Caracas	... A variety of cacao
Caramba, Carambola	... Averrhoa Carambola
Carandas	... Carissa Carandas
Caravonica	... A variety of cotton
Caraway	... Seed of Carum carvi
Carbohydrate	.. A compound of carbon, hydrogen, and oxygen, the latter two in the proportions to form water.
Cardamoms	... Fruit of Elettaria Cardamomum
Caricature plant	Graptophyllum hortense
Carina	... A keel
Carnauba	... Copernicia cerifera
Carob-tree	... Ceratonia siliqua
Carpel	... One of the ovule-bearing leaves of the flower.
Carpophore	... Portion of receptacle bearing carpels
Carpophyll	... Carpel
Carrot	... Daucus Carota
Carrot (Peruvian)	... Arracacia xanthorhiza.
Cartagena bark	Cinchona cordifolia
Caruncle	... A small hard aril.
Casein	... The chief proteid of milk, and the main constituent of cheese.
Cashew	... Anacardium occidentale
Cassareep	... The poisonous juice of cassava evaporated to a syrup, and thus rendered harmless
Cassava	... Manihot utilissima, etc.
Cassie flower	... Acacia Farnesiana
Castor oil	... Ricinus communis
Catalase	... An enzyme
Catch crop	... A crop grown between the lines of another which is yet in an early stage
Catechu	... Acacia Catechu
Catkin	.. A dangling spike
Catty	... $1\frac{3}{4}$ lbs. (100 catties=1 pikul)
Caucho	.. Caoutchouc: Castilloa
Caudex	... A trunk or stock
Caudicle (orchids)	... The tail of a pollen-mass
Caulescent	... With obvious stem
Cauliflower	... Brassica oleracea, var.
Cauline	... Upon the stem
Ceara rubber	... Manihot Glaziovii
Cedar (of S. India)	... Cedrela Toona
Ceiba	... Eriodendron anfractuosum
Celery	... Apium graveolens
Cell	... A cavity; or one of the minute units of which a plant or animal is built up
Cellulose	... The carbohydrate of which the bulk of the firm tissue of a plant is composed

Centimeter ... $\frac{1}{100}$ of a meter
Centrifugal ... Away from the centre
Centripetal ... Towards the centre
Century plant ... Agave Americana
Cereal ... A grass with seed fit to eat
Cernuous ... Nodding
Cestode ... Tape worm
Ceylon oak ... Schleichera trijuga
Chalaza ... The end of the ovule next the stalk
Chana (Ind.) ... Cicer Arietinum
Charas ... The resin of hemp
Chartaceous ... Of papery texture
Chaulmoogra ... Gynocardia odorata or Taraktogenos Kurzii
Chaval (Ind.) ... Rice
Chaw stick ... Gouania domingensis
Chayote ... Chocho
Chay-root ... Oldenlandia umbellata
Check-roll ... Roll of coolies at work
Cheddi ... Jungle scrub
Chekku ... Oil-mill
Chena ... Cutting of forest or scrub, burning off, and cultivating a crop or two
Chena (Ind.) ... Panicum miliaceum
Cherimoyer ... Anona Cherimolia
Cherry ... Prunus Cerasus
Cherry (Barbadoes) ... Malpighia glabra, etc.
Cherry bean ... Vigna sinensis
Cherry (in coffee) ... The berry (with the fleshy coat attached)
Chestnut (Australian or Moreton Bay)... Castanospermum australe
Chestnut (Pahito) Inocarpus edulis
Chestnut (water) Trapa
Chetty ... A money-lending caste
Chickling-vetch.. Lathyrus sativus
Chiku (Malay) ... Sapodilla
Chilly ... Capsicum annum
China tea ... A variety of tea
Chinese nut ... Arachis hypogæa
Chinese olive ... Canarium commune
Chips ... The inferior quality of cinnamon bark
Chlorophyll ... The green colouring matter of plants
Chocho ... Sechium edule
Chocolate ... Cacao
Choki ... A log drawn over the ground by bullocks
Chola (Ind.) ... Vigna Catjang
Cholam ... Guinea Corn
Chowlee (Ind.) ... Vigna Catjang
Christophine (W. Ind.) ... Chocho
Chrysalis ... Stage intermediate between caterpillar and moth in butterflies and moths
Chua (Ind.) ... Amarantus paniculatus
Chula ... Charcoal stove for drying tea
Chunam (Ind.) ... Lime cement
Cilia ... Fine hair along an edge
Ciliate ... With cilia
Ciliolate ... With little cilia
Cinchona ... A genus of Rubiaceæ, notable for barks containing quinine, cinchonidine, &c.
Cinchonidine ... An alkaloid from Cinchona bark
Cinnamon ... Cinnamomum zeylanicum (wild Ceylon) Litsea zeylanica
Circinate ... Coiled up in bud
Circumscissile ... Splitting off a lid
Cirrhiferous ... Tendril bearing
Cirrhus ... A tendril
Citral ... An alcohol of citronella oil
Citronella ... Oil distilled from the grass Cymbopogon Nardus
Cladode ... A stem flattened out to resemble a leaf
Clavate ... Club-shaped
Clavellate ... Diminutive of clavate
Clawed ... With a narrow projecting part
Clay ... A stiff soil, containing a large percentage of extremely finely-divided matter
Claying ... Rubbing wet cacao beans with clay
Clearing nut ... Strychnos potatorum
Cleft ... Cut half-way down
Cleistogamous (flower) ... One that does not open
Clove ... Eugenia caryophyllata
Cluster bean ... Cyamopsis psoralioides
Coagulate .. Cause to run together
Coarse plucking Plucking the bud and three or more leaves
Cob ... Stout axis on which grains of Indian corn grow
Coca ... Erythroxylon coca
Cocaine ... The alkaloid of coca
Coccidæ ... Scale-insects
Cocoon ... Outer envelope formed round the pupa in insects
Cocculus indicus ... Anamirta Cocculus fruits
Coccus ... A portion of a fruit that breaks up without opening
Cochineal ... The dye of Coccus cacti (scale insect)
Cockspur Thorn Acacia eburnea
Cocoa ... Theobroma Cacao

Cocoa butter ... The expressed oil of cacao seeds
Cocoa nibs ... The husks of cacao seeds
Coconut ... Cocos nucifera
,, water ... Nipa fruticans
Coconut beetle:
Black ... Oryctes rhinoceros
Red ... Rhyncophorus ferrugineus
Cocoplum .. Chrysobalanus Isaco
Coffee leaf disease ... Hemileia vastatrix
Coffee, Arabian Coffea Arabica
,, , Liberian Coffea liberica, &c.
Cogon (Phil. Is.) Illuk, Imperata arundinacea
Cohune palm ... Attalea funifera
Cohesion ... Union of parts of the same nature, *e.g.*, petals
Coir ... Coconut fibre
Cola ... Cola acuminata, &c
Cold drawn ... Drawn by crushing in the cold
Cold storage ... Storage in chilled air
Coleoptera ... Beetles, &c
Collar ... The junction of root and stem
Collar pruning ... Pruning at the collar
Collateral (bundle) ... One with wood and bast side by side
Colloid ... A substance which will not diffuse through a membrane
Colocynth ... Citrullus Colocynthis
Column (Orchids, &c) ... A central mass in the flower, made up of stamens, style, &c.
Coma ... A tuft of hairs
Commensalism Living together for mutual benefit
Commissure ... Face by which carpels cohere
Complicate ... Folded on itself
Compost ... A mixture of manures
Compound leaf Of several leaflets
Condenser ... A cooler to condense the vapour that is being distilled
Conduplicate ... Folded lengthwise
Conessi bark ... Holarrhena dysenterica
Confervoid ... In the form of filmy threads
Confluent ... Blending
Conglomerate ... Sedimentary rock largely composed of pebbles
Congou ... A coarse tea
Conidia ... Branches bearing asexual spores
Conifers ... Pines, Yews, Cypresses, &c.
Conjee ... Rice-water
Connate ... United
Connective ... The part of the stalk uniting the lobes of an anther
Connivent ... Converging
Contagious ... Communicated by contact
Contorted ... Twisted
Control plot ... A plot to which nothing is done, to compare with plots treated in various ways
Convolute ... Twisted
Cooly ... A man on daily pay
Co-operative Credit Society A society in which all the members contribute, and which makes loans to its own members only
Copal, Indian ... Vateria indica
Copious branching, &c. ... Abundant
Coppice ... To cut down nearly to the ground, so that a tuft of stems arises instead of one
Copra ... Dried coconut kernel
Coquilla nut .. Attalea funifera
Coquito nut ... Jubæa spectabilis.
Coral tree ... Erythrina
Cordate ... Heart-shaped
Coriaceous ... Leathery
Coriander ... Coriandrum sativum
Cork ... The waterproof outer bark, especially well developed in the "cork" tree
Cork cambium ... The cambium which forms the cork in the outer part of the bark
Cork wood ... Ochroma lagopus
Corm ... A swollen stem as in Crocus
Corn, Indian ... Maize
Corn, broom or guinea ... Sorghum vulgare
Corolla ... The inner row of leaves of a flower usually brightly coloured
Corolline ... Of corolla nature: attached to corolla
Coromandel wood ... Calamander
Corona ... An outgrowth of corolla or stamens, forming a kind of crown in the flower
Coroy ... Albizzia odoratissima
Corpuscle ... A small body
Cortex ... Outer tissue of a green stem

Corymb ... An inflorescence of raceme pattern, but with all the flowers coming to one level, as in Candy tuft
Corymbose .. Of corymb nature
Costa ... A rib
Cotton .. Gossypium species
Cotton boll weevil ... Anthonomus grandis
Cotyledon ... A seed leaf
Coulter ... The knife-like instrument at the front of a plough that makes the vertical cut of the furrow
Country almond Terminalia Catappa
Courbaril ... Hymenæa Courbaril
Cow-age or-itch Mucuna pruriens
Cow-pea ... Vigna sinensis
Cowrie pine .. Agathis australis
Crab oil ... Carapa guianensis
Crabseye ... Abrus pecatorius
Cream fruit ... Roupellia grata
Creat ... Andrographis paniculata
Creeper, Canary Tropæolum peregrinum
Crenate ... With rounded teeth and sharp notches between them
Crenulate ... Dimunitive of last
Creosote ... A liquid obtained by distilling tar
Crepe ... A form of dry rubber due to its passing through a machine
Cretaceous ... Chalky
Crinite ... With soft hairs
Criollo ... A variety of cacao
Crossbred ... A cross between races
Crown bark ... Cinchona officinalis
Crown palm ... Maximiliana regia
Crustaceous ... Hard and brittle
Cryptogam ... A non-flowering plant, *e.g.*, fern or fungus
Cubebs ... Piper cubeba
Cubic centimeter ... The cube of a centimeter
Cucullate ... Hooded, cowled,
Cucumber ... Cucumis sativus
Culm ... Calabash, Lagenaria vulgaris, stem of a grass
Cultivator ... A machine with teeth that tear up the ground
Culture system... cf. Willis, Agriculture in the Tropics, p. 151
Cumari (S. W. India) ... Chena
Cumbu ...Pennisetum typhoideum
Cumquat ... Citrus japonica
Cundeamor ... A variety of cacao
Cuneate ... Wedge-shaped
Cuneiform ... Wedge-shaped
Cupular ... Of cup form
Curing ... Preparing for market in such a way as to prevent further change occuring after packing
Curry leaf ... Murraya Kœnigii
Cusp ... A rigid point
Cuspidate ... With cusp
Custard apple ... Anona squamosa
Cutch ... A tanning extract from Acacia, &c.
Cutting ... A piece of a plant removed, large enough to grow when planted
Cutworm ... Caterpillars of Agrotis sp.
Cyanamide ... Calcium cyanamide, Ca CN^2. made by passing nitrogen over heated calcium carbide
Cymbiform ... Boat-shaped
Cyme ... An inflorescence in which the oldest flowers are central, the younger further out
Cystolith ... A lump of substance secreted in a cell
Dadap ... Erythrina lithosperma
Daisy-tree ... Montanao bipinnatifida
Dal ... Cajanus indicus
Dammar ... Resin of Agathis, &c.
Dammar, white.. Vateria indica
Damping off ... A fungus disease of seedlings caused by a Pythium
Damson plum (W. Ind.) ... Chrysophyllum Cainito
Danchi (Ind.) ... Sesbaria aculeata
Dangar ... Rice
Deal ... Wood of pine and conifers
Deccan hemp ... Hibiscus cannabinus
Deciduous ... Falling annually
Declinate ... Bent down or forward
Decomposition ... Breaking up into simpler substances
Decomposed ... Several times divided
Decorticate ... Remove the shell
Decumbent ... Bending upwards from a prostrate base
Decurrent (leaf)... Running down along the stem
Decurved ... Curved down
Decussate ... In pairs, at right angles, one pair E. and W. the next N. S.
Defæcating ... Purifying sugar juice
Definite ... Ending at a definite point
Deflexed ... Bent sharply out or down
Defoliate ... Remove the leaves

Degum ... Remove the gum
Dehiscent ... Opening
Deliquescent ... Gradually liquefying by absorbing moisture; stem breaking up into branches
Deltoid ... △ -shaped
Denitrification ... Decomposition of nitrates, &c. in the soil, with evolution of free nitrogen
Deniya ... A level expanse
Dentate ... Sharply toothed
Denticulate ... Diminutive of last
Denudation ... Washing away of superficial layers
De-oxidation ... Removal of oxygen
Depressed ... Pressed down
Desi (Ind.) ... Nicotiana Tabacum
Desiccated Coconut ... Coconut kernel, with part of the oil expressed, sliced and dried
Desiccator ... Drying machine
Devil nettle ... Laportea crenulata
Dextrin ... A product formed during the action of diastase upon starch
Dhaincha (Ind.) or Dhainchi ... Sesbania aculeata
Dhak (Ind.) ... Butea frondosa
Dhal (Ind.) ... Cajanus indicus
Dhan (Ind.) ... Rice
Dhania (Ind.) ... Coriander
Dhaura ... Anogeissus latifolia
Dhunchi (Ind.) ... Sesbania aculeata
Dhurra (Egypt) ... Millet
Diadelphous ... In two bundles
Diagnosis ... Determination of complaint
Diaphragm ... A dividing membrane
Diastase ... An enzyme that converts starch to sugar
Dibble ... A pointed piece of wood for making holes in the ground
Dichlamydeous ... With two coverings, calyx and corolla
Dichotomous ... Forking into two equally
Dicotyledon ... Plant with two seed leaves
Didymous ... Twinned
Didynamous ... Two longer than the others
Die-back ... Gloesporium sp., followed by Botryodiplodia elasticæ
Diffuse ... Loosely spreading
Digitate ... Like the fingers of a hand
Dilated ... Expanded at the end
Dimidiate ... Halved
Dimorphic, Dimorphous ... Of two forms
Dioecious ... Male and female on separate plants
Disarticulated ... Separated at a point
Disbudding ... Removal of some buds to allow others to grow
Disc ... An expansion in the flower above the calyx
Disc-harrow ... A harrow made of revolving discs on a bar, and set at an angle to the direction of progression
Disciform ... Disc-shaped
Discoid ... Disc-like
Dissepiment ... Septum or partition
Distal ... Furthest from axis
Distichous ... In two ranks
Dita bark ... Alstonia scholaris
Divaricate ... Very divergent
Diveli (Ind.) ... Castor oil
Divi divi ... Cæsalpinia coriaria
Dolabriform ... Hatchet-shaped
Dolomite ... A "limestone" composed of calcium and magnesium carbonates
Dominant (in breeding) ... Applied to a character in which the first cross resembles one parent
Doob Grass ... Cynodon Dactylon
Doorwa (Ind.) ... Cynodon Dactylon
Dorsal ... Rear side of flower, next axis from which it is a branch
Dorsifixed (anther) Joined to stalk by whole length
Double flower .. Flower with stamens changed to petals
Dressing ... Sprinkling over the surface
Drill ... Machine for sowing seeds or laying manure at regular distances
Drip tin ... A tin for causing a drip of water into a cut upon a rubber-tree
Drip-tip ... A long sharply pointed leaf-apex
Drumstick ... Moringa pterygosperma
Drupe ... A fleshy fruit, with a hard covering round the seed, as in cherry
Dry farming ... Farming in very dry regions, where the rainfall is worked into the soil by immediate tillage
Dry grains ... Grains cultivated without irrigation
Dry rot ... A disease due to the fungus Merulius lachrymans
Diffin bean ... Lima bean
Durian ... Durio zibethinus

ORIENTAL *VERSUS* OCCIDENTAL LABOUR.

Western conception of what is referred to as the "cheap" labour of the East is being slowly but surely revised. Congressman Redfield, of New York, who recently visited the Philippines and other eastern centres, upon his return to Washington, participated in the debate on the revision of the wool schedule, refuting the argument of the old guard of the republican party that its reduction would expose the wool industry to the menace of the product of cheap labour from abroad. He claimed that the so-called "cheap" labour was more expensive than the highest paid labour of America. The *Saturday Evening Post* gives the following on his speech :—

"Congressman Redfield, of New York, has been engaged in manufacturing for many years and has travelled much abroad, selling American manufactures. In a speech on the bill to reduce wool duties he gave a number of his own personal experiences. The following are samples :

"Wages in a Japanese locomotive plant were only one-fifth of the American scale ; but comparison of the cost sheets showed that "the labour-cost for locomotives on the same specifications was three and a half times greater in the Japanese shop than in the American shop."

"I saw them driving piles in Japan—twenty women, each with a rope, lifted the pile ; they were paid twenty cents a day in our money." Yet it cost four times as much to drive those piles as it would have cost in New York.

"I was in a brickyard at Singapore. Their rate of pay was thirty-five cents a day in our money." But a comparison of the books at that Singapore brickyard and at one in an Eastern city of the United States showed that the labour-cost in America was no higher than in China.

"The debate on the wool bill is embellished with long tables showing wages paid in American mills and those paid in foreign mills ; but every schoolboy should know by this time that a comparison of wage scales means nothing. The cost of production may be less with the highest-priced labour than with the cheapest labour."

Mr. Redfield expressed his opinion on Oriental labour as he found it. It had not been developed. Indeed, it might be said that from a western viewpoint, the labour he referred to simply represented material out of which the real labourer might be moulded. Labour in the East has, generally, the same status it had centuries ago.

It is the same half-starved, undeveloped, neglected and oppreseed labour. Where an effort has been made to develop it by proper supervisicn, with proper food and clothing, it has not been a disappointment. By giving the eastern labourer a chance he has been found to increase his earning power as a producer. This has been demonstrated in the Philippines and Hawaii among Malay labourers,

But Mr. Redfield would have found where the developed labourer was employed, that the increased wages paid were in direct ratio to his increased capacity to produce, and confirms the Congressman's claim that labour cost measured by efficiency is about the same the world over.

AGRICULTURAL AND INDUSTRIAL PROBLEMS.

(From the *Indian Agriculturist*, Vol. XXXVI., No. 3, March 1, 1911.)

(A paper read by Mr. P. N. Banerji at a meeting of the Zemindars and Khandsalis Association, Bareilly, presided over by Mr. P. A. Allen, I. C. S., Collector.)

I believe it was Lord Rosebery, who in one of his brilliant and humorous speeches, said, "It is one of the ironies of the world in which we live that public men are called upon to perform every kind of duty, even those for which they are least qualified." I have not the least doubt that I know less of the subject which we are here to discuss than anybody in this hall. It may be asked then why I am here. I am here, gentlemen, in obedience to a mandate of our esteemed President. I accepted this mandate from a sense of duty that perhaps some good will result by bringing to your notice a few facts concerning certain aspects of our present-day agricultural and industrial problems.

Sir, this association was ushered into existence under your patronage, about two years ago ; at least I for one was optimistic enough to expect some good result out of its existence. It is too early yet to make any stock of its work, but I am sure as time goes on we shall better be able to justify our existence and to show some tangible results.

Our association is principally concerned with the Khundsal or Sugar industry. You are aware that this is the chief industry of our district. I remember that about 20 or 25 years ago this industry was in a prosperous and flourishing condition. What is its condition now? I think I shall be quite justified in describing its condition as moribund. I am afraid it is almost at its last gasp, and why? You remember that at one time we used not only to make our own cloth, but we also exported it to foreign countries. That trade, the cottage loom trade, was killed by power looms.

By the same process our sugar industry, which is nothing but a cottage industry, is being gradully but surely killed by the factory power. The inevitable result has been averted on account of the orthodoxy of our people. But we cannot hold on indefinitely, and so it is vanishing. With all the resources of our country we are unable to compete with foreign sugar. The other day I was reading an excellent article in one of the leading Anglo-Indian papers on this subject. The writer who seems to be an expert, in the course of the article said: "There is no reason why India should not grow all the sugar she requires and have quite a solid margin to spare for export. With improved solid methods of cultivation, selected cane and up-to-date mills, the final goal seems well within reach, but perhaps things will go on in the old, old way, till some sugar expert takes the matter in hand, erect a central factory in a good cane-growing locality, and sees that the canes are planted around the factory or within easy reach of it by light Railway or Tramway."

I am sure you will excuse this long extract, but I really think the writer put in a nut-shell the whole question. What are our difficulties?

1. The methods of cultivation are defective.
2. The canes are not what they should be.
3. The mills are not up-to-date.

The question of a great central factory we may well keep out of view at present. But can we not do something to improve the other things? We have a large number of people here in our city and also in the district, men of wealth and intelligence who have been in this trade for a long time, and cannot they be persuaded to take the initiative in this matter, if for nothing else at least for self-preservation. The Indian canes at the best are not nearly as good as they might be. The whole system is faulty from beginning to end, and will have to be altered. It can certainly be altered for the better, as witness the vast strides in sugar production in Java, Formosa and the West Indies. Since the introduction of the central factory system, Java, Mauritius and the West Indies indent labour from India, and still they beat us with one of the weapons we ourselves place in their hands.

Now we are importing sugar, mind the absurdity of the whole thing. India, which ought to be one of the greatest sugar-producing countries, is importing sugar to the extent of eleven and a half crores of rupees every year. This vast sum by a little judicious manipulation of existing methods could be kept in the country instead of being paid away mostly to Java. The Indian cultivators, I admit, are very conservative, but they are not fools. If you can bring it home to them that their system of cane cultivation is faulty, and that the canes are not good, place within their reach better and selected canes and give them better mills, they will give up the old methods and adopt yours. Cannot one of our wealthy Khundsalis be persuaded to start an agricultural experimental farm.

Show the agriculturist how to manure the land first, what cane to plant, and then get some improved mills and demonstrate to them how to do this business from start to finish. While doing this, you can also show them how to improve their grain cultivation, place within their reach better seed, and demonstrate the result by doing things yourselves in your experimental farm. Just consider what immense improvement has been made in America in this direction. Follow in their footsteps and prove to your tenants that they could also do the same with benefit to themselves and with increased profit to yourselves. I say with great regret, but nevertheless it is true, that our Zemindars have not done their duty to their peasantry. It is their duty only to collect their rents by all manner of means, and spend the same on themselves to live luxurious lives? Complain of the assesment, and do nothing whatever to improve the condition of the peasantry? There is universal complaint that the land is being impoverished by over cultivation. There is also a general complaint of the impoverishment and deterioration of the cattle of the country. Unfortunately many of our Zemindars think that if they can keep themselves in the good graces of the circle inspector and the Tahsildar, keep the mighty Patwari

Khus, and make a round of salams to the Bara and Chhota sahibs, they have done their duty and the Sirkar is pleased. I do not ask them to give up their present occupation which perhaps is a pleasant and profitable pastime, but please do not make that the be-all and end-all of your existence. I can assure you that the Sirkar will be more pleased and appreciate your work if it finds that the Zemindars take real interest in their peasantry by helping them in improving their land, the quality of their grain and the condition of their cattle. Some of our Zemindars with this object can send their sons or other relations to some Agricultural College, say to Cawnpore, to learn the improved methods of cultivation and their allied subjects, and after learning all they have to learn, return to their homes and give their tenants the benefits of their education. Another thing which is a disgrace to our country is the hopeless indebtedness of the peasantry. For this the peasant is to a certain extent to be blamed, but poor man, he is left to himself without anyone to help him, and he gets more and more into the clutches of the money-lender. Why cannot the system of the agricultural banks be introduced here with profit to the Zemindar and to the salvation of the peasantry. I am glad to notice that this has been started in several places with marked success. In this connection allow me to read to you an extract from the "Statement" exhibiting the moral and practical progress and condition of India during the year 1908-1909:—"The movement has almost everywhere passed out of the experimental stage; a large number of the Societies are firmly established on a self-supporting basis, and they are winning more and more the appreciation and confidence of the people. Loans are well and punctually repaid. It is noteworthy that in spite of the large increase in working capital the amount lent by the State is but little larger than the previous year." Our association can do something in this direction and show how it can be done, and save the tenants from the hands of the money-lenders. Then another thing that you can do is to give some sort of primary education to your tenants. Begin in a small scale, say with at least one school in every village where there is none. Teach them reading and writing and to keep accounts, and also something about elementary sanitation and other useful subjects. Perhaps night schools would be more welcome than day schools. But these are matters of detail which you could decide for yourselves. What I wish you to do is to realise your responsibilities, improve the condition of the peasantry, treat them with kindness, and you will reap a rich harvest for yourselves. I would like in this connection to bring to your notice some of the industries which could be profitably taken in hand by our monied men. You must have noticed that some of the butchers of our town have built palatial buildings, and have within a comparatively short time become wealthy by exporting raw hides. I do not ask every one of you to follow their example. But certainly a factory can be opened here to tan these raw hides instead of exporting them in their raw state of the value of 10 crores of rupees every year. We not only do this, but to oblige the foreigner we export tanning materials so that he may tan the hides and send them back to us in the shape of leather and manufactured goods. I was surprised, Sir, when I read that India of all countries where wood of all sorts is plentiful should pay 38 lakhs every year for tea chests to export the tea which we grow in this country. How is it that we cannot make our chests in the country and save this money? Cannot we in Bareilly start some industry to supply sheets to the exporters of tea? Then we import matches to the value of 82 lakhs every year, as also soap, glassware, earthenware, not to speak of other articles. We pay every year something like 40 to 50 crores of rupees for articles which could easily be manufactured in this country. Just think how our country would be enriched if we could keep all this money in the country. This will give employment to thousands of our young men who do not know what to do after finishing their education. The problem of our boys will thus be solved. You cannot, and you ought not to, expect that the Government will be able to provide all your sons and your nephews with suitable appointments. With all the desire to help you, the Government is helpless as the appointments are limited but the number of candidates are many. The professions are already over-crowded. Moreover, it is not given to every one to win the prizes of the professions. So instead of crowding the ranks of the candidates for Government employment and the professions, our young men will find other lucrative careers opened for them. No nation has been made self-contained and self-respecting whose educated young men look only to Government for employment and crowd the ranks of the professions, and increase the number of grumblers and dis-

contents. Look how we grumble that we do not get good milk, good butter and good ghee. Whose fault is this? Do we do anything to remove the complaints? Those of our young men who fail year after year to pass the University examination may surely employ their misdirected energies into better use by joining some technical or agricultural seminary and carve out a career, honourable to themselves and profitable to the country. The more such avenues of work are widened you will find more amity between the two great communities of this country who now fight for the loaves and fishes of office. Gentlemen, it is my firm belief that the salvation of our country will not take place till we have thoroughly improved our agricultural and industrial condition and elevated the position of our rural population. Mr. Chairman, these are some of the problems with which we are confronted at the present time. We have reached a stage in our progress as a people which can well be described as a parting of the ways. We cannot stop giving education to our people. It is the birth-right of every child to be educated. But we must put our educational system on a more sound and practical basis. We must direct our attention more and more to scientific and technical education side by side with the education our boys are now receiving. The world is moving onward, we cannot afford to stand still, stagnate and die. I have placed before you some suggestions. I feel they are not adequate. But let us face our difficulties squarely and find out solutions. Our attitude of drifting on will not help us. So let us be up and doing and move onward till the goal is reached.

FLIES AS DISEASE CARRIERS.

(From the *Veterinary News*, Vol. VIII., No. 399, August 26, 1911.)

In the third report to the Local Government Board on flies as carriers of infection, issued in August, 1910, Dr. Monckton Copeman stated that it was proposed to devote special attention to the elucidation of the question as to the range of flight of flies both in horizontal and vertical directions. In this connection he said that arrangements had been completed at Cambridge for the location of a number of stations at which fly-traps of various kinds could be installed. The flies trapped at the various stations would be examined and counted with special reference to "marked" individuals. In this way some definite idea could be formed as to the distance a fly can travel, and as to its rate of travel. Unfortunately, circumstances arose which prevented these experiments being carried out in Cambridge, but an opportunity arose of conducting them on somewhat modified lines in the neighbourhood of Norwich.

In July, 1010, there was an unprecedented plague of flies in Postwick, a small village some five miles from Norwich. Within about half a mile of the village, and with the river Yare intervening, is situated the Norwich sewage farm, on which the house refuse from that city is deposited, being brought down the river by barges. Upon investigating the circumstances, Dr. Copeman, who was accompanied by Mr. F. M. Howlett, B.A., F.E.S., and Mr. Gordon Merriman came to the conclusion that there was in the village no unusual accumulations of manure or other fermenting refuse affording special opportunity for the breeding of house-flies in such large numbers as were found to be present. Attention was then drawn to the refuse heap on the Norwich sewage farm, where it was found that fermentation was still actively going on, the new portions steaming vigorously when the top layer was disturbed—altogether an ideal breeding place for house-flies. Near to the refuse heap was a workman's hut heated by a stove which was kept continuously burning day and night. Into this hut the flies swarmed incessantly, and four lots were caught at intervals of a month in July, August, September, and October. The first lot were sent for identification to Mr. E. E. Austen, F.Z.S., of the Natural History Museum. The majority of them were found to be the common house-fly (*Musca domestica*). The flies caught in August were marked by shaking the net in which they were caught in a stout paper bag containing a small quantity of finely-powdered coloured chalk, using as a rule a different colour in each of four days, yellow and red being found to be the best colours. After having been marked, the flies were liberated. About 3,000 were set free on August 20, and on the following day one was observed 400 yards distant, and one in Postwick Church over 1,000 yards away, and on August 22 one was seen 1,000 yards from the refuse tip. On August 21, 1,000 were liberated, and of these five were caught on the two succeeding days at distances varying from 800 yards to 1,408 yards. About 2,000 were set free on August 22, of which number fifty were caught up to August 26 at spots also varying

in distances from the tip cf 800 yards to 1,408 yards. In one instance a marked fly was caught 800 yards from the point of liberation 35 minutes after it had been set free.

To the report from which we have quoted the above interesting and highly instructive facts, Dr. G. S. Graham-Smith contributes an account of observations which he has made on the ways in which artificially infected flies carry and distribute pathogenic and other bacteria. The experiments which he carried out demonstrate definitely that artificially infected flies, both house-flies and blow-flies, are capable of infecting fluids, such as milk and syrup, on which they feed and into which they fall. "In the case of the house-fly, infected with certain micro-organisms (*B. prodigiosus* and *B. anthracis*), gross infection may be produced in milk for at least three days, and a smaller degree of infection for six to nine days, or even longer. Blow-flies produce gross infection for six to nine days, with non-spore-bearing micro-organisms (*B. prodigious* and *B. pyocyaneus*), and some degree of infection for three or four weeks." Dr. Graham-Smith considers it probable, at any rate in the later stages, that infection is mainly due either to direct infection with the crop contents vomited through the proboscis, or to indirect infection by means of the limbs which have been reinfected with vomited material during the process of cleaning them.

SNAKE-BITE AND ITS TREATMENT.

(From the *Queensland Agricultural Journal*, Vol. XXVI., Part 3, March, 1911.)

So many cases of snake-bite have occurred during the last two months, two being fatal, that we think it advisable to republish an article on this subject which appeared in the December issue of this Journal, 1905, entitled "Snake-bite and its Treatment."

A correspondent has written suggesting that, in the interests of miners, some information should be given in the Journal concerning snake-bites and the best known methods of treating them. It is an undoubted fact that men engaged in mining and in prospecting run great risk from snakes, both on the surface and in abandoned shafts, which often have to be re-opened; and, as such men are generally far removed from medical aid, it is well that they should know the best thing to do when anyone is bitten, and that the means to be adopted should be as clearly and widely made known as possible. Unfortunately, as far as internal remedies are concerned, investigations by competent authorities go to prove, as will be more fully explained later on, that to be armed with a reliable antidote is not nearly such a simple matter as the correspondent mentioned seems to think. He has been informed that the poison of the deaf adder acts on the nerves, while that of the black, brown, and other venomous snake acts on the blood; and suggests that the miner be made familiar with a specific for each class of bite of such a nature that he could be provided with it, and ready for any emergency. Dr. A. Muller, however, in his work on "Snake Poison: Its Action and its Antidote," came to the conclusion, after full investigation and experiment, that all snake venom is a nerve poison; but Professor Martin, who, when in Australia, also made a study of the subject, seems to draw some distinction, inasmuch as he refers to the futility of the generally accepted remedies to prevent the clotting of blood caused by all Australian snake poisons except that of the deaf adder. Dr. Muller advocated the strychnine cure as a remedy in all cases of snake-bite; but, as he admits that it may be necessary at some stage of the treatment to administer strychnine in doses which, in the absence of the snake poison, would be fatal, it will be seen how dangerous it might be to try such a remedy without professional aid, even if later investigations had not considerably discredited—as indeed they have—this form of remedy. As to having the right antidote available, it is true that anti-venomous serum has been mentioned in this connection, but as one must apply the right antidote to the right snake, this remedy is hardly practical under ordinary conditions.

HOW TO DISTINGUISH NON-VENOMOUS FROM VENOMOUS SNAKES.

In cases of snake-bite, it is, of course, very important to determine whether the reptile inflicting the injury is venomous or not. Many persons have undergone much pain and often risk from heroic treatment for bites which they have supposed to be those of venomous snakes, but which a knowledge of the external characters of the different species would have shown to have been perfectly harmless. Indeed, it is believed that not a few persons bitten by harmless snakes have been killed either by fright or the treatment to which they have been subjected; while many records of recovery under certain treatment are unreliable on account of the

doubt existing as to whether the reptiles inflicting the bites were really venomous.

As a matter of fact, far more of the Australian snakes are non-venomous than is generally supposed. The late Dr. Krefft, for many years Curator of the Australian Museum, Sydney, and a recognised authority on Australian snakes, describes twenty-one innocuous and forty-two venomous snakes of this country; but of the latter, he says, not more than five species are dangerous to man or the larger animals, and these retire underground for nearly five months of the year. The four Queensland snakes which are mostly to be dreaded are the deaf adder, the black snake, the brown snake, and the tiger snake. To the miner, prospector, and ordinary bushman, many opportunities are afforded of examining dead snakes; and, with a little observation and study, he might soon be able to tell at a glance the poisonous from the harmless species.

In the first place, on opening the mouth of a non-venomous snake, a row of small teeth will be seen along each jaw, and when such a snake bites he leaves two rows of small punctures, thus—

: :
: :
: :

In the venomous snake these small teeth are rudimentary, and leave no marks; but towards the outer edge of the upper jaw there are two fangs, and the punctures left by the bite from these are two in number, thus— . . These fangs which are the means by which the poison is conveyed from the snake to the person bitten, are not always in a state of projection, and it may be necessary to press the gum down with a stick or penknife before they can be seen; but this should be done with caution, and when it is certain the snake is dead. Sometimes, however, the punctures are not sufficiently distinct for them to be accepted as a reliable guide; but where the snake is seen there are other characteristics which will assist in the identification. According to Dr. Krefft, the gape of the mouth of the non-venomous Australian snake is usually curved upwards; while in the venomous it forms a straight line. Again, an important distinction is to be found in the labial (lip) scales. Dr. Krefft says that of the labials there are seven or more in non-venomous snakes, while in the venomous "there are generally only six (we may say always six—never more)." He adds that "it may safely be asserted that by these shields alone can the harmless or venomous character of snakes be ascertained. This rule does not apply to sea snakes, nor to blind snakes of the family *Typhlopidæ*, but to Australian venomous and innocuous colubrine snakes only." Another distinctive mark is that in the non-venomous snake there is a loreal scale, which is absent in nearly all Australian snakes. This loreal scale is a supplementary scale which, in the non-venomous snake, is to be found on the cheek between a labial scale below and a frontal scale above, and between the ocular and nasal scales. In the venomous snake these four scales—the labial, frontal, ocular, and nasal—all unite at one point, and are not separated from each other, as in the harmless snake by the loreal scale.

The head and mouth characteristics which distinguish the two classes of reptiles can be seen at a glance from the accompanying reproduction of excellent photographs taken from Nature by Dr. John Thomson, of Brisbane, who is a keen student of this subject, and who kindly placed his pictures and other useful information readily at our disposal for the purpose of this article.*

Dr. Thomson also has in his possession a diagram (in the shape of Fig. 2*) showing, in such a way that "he who runs may read," the chief distinguishing features between the venomous and harmless snake. This diagram, which was originally prepared to illustrate a lecture, should be cut out, and kept by persons in the bush in some place where it may be readily and often seen, so that its points may become impressed on the mind.

TO DISTINGUISH VENOMOUS FROM NON-VENOMOUS SNAKES BY HEAD CHARACTERISTICS (KREFFT).

Venomous.	Non-venomous.
Gape of mouth, straight	Gape of mouth, curved upwards
Labial scales, six	Labial scales, seven or more
Loreal scales, absent	Loreal scales, present
Bite marks . .	Bite marks : : : : : :

Dr. Krefft states that an Australian snake that is not thicker than a man's little finger, whatever may be its length, cannot by its bite endanger the life of an adult human being. It may be added that the true *fresh* water snake is always harmless, while the saltwater or sea snakes are always poisonous. Few of the tree snakes are venomous; while the carpet snake and the so-called "green snakes" are innocuous. Very often a thick woollen sock or stocking will prevent injury from the bite of a snake, as

* Not reproduced.

the fang may not penetrate sufficiently far for the poison which passes down its groove to be injected beneath the skin. There is a very widely accepted belief that the deaf adder inflicts injury by a *sting* from its tail, but this is not the case.

The general symptoms exhibited by persons bitten by a venomous snake are: Great anxiety, depression and postration, feeble and intermitting pulse, profuse cold sweats, vomiting, hurried respiration, indistinct speech, dilation of the pupil of the eye, drowsiness, and finally, in fatal cases, unconsciousness and convulsions.

TREATMENT OF SNAKE-BITE.

Professor Martin, late of the Melbourne University, who some time ago was appointed Director of the Lister School of Preventive Medicine in London, before leaving Melbourne, delivered a lecture embodying the results of several years of research into Australian snake poisons. The results of his investigations are somewhat disappointing as far as the generally accepted remedies are concerned. He says, that for all snakes except the deaf adder the only remedy that is of the slightest use is the ligature, applied immediately. He adds—

"If the bite be on the tip of the finger, the ligature may be tied round the base of the finger, if done instantly. If not, we must go higher. It is no use tying anything round the wrist or forearm, nor round the leg below the knee, for in these places the limb consists of two bones, and the circulation cannot be stopped by a band of any sort. We must go above the elbow or above the knee, where there is only a single bone. The ligature must be tied as tight as possible—twisted tight with a stick—for no blood must pass. In half an hour's time the ligature may be removed.

"All the usual remedies, such as ammonia, strychnine, and chloride of lime injections, whisky, and exercise, are powerless to check the clotting of blood caused by all Australian snake poisons except the deaf adder. Cutting out the piece and gashing the limb to make it bleed is equally futile. Antivenomous serum is a remedy, but hardly a practical one, as you must apply the right antidote to the right snake."

Other authorities do not go so far as Professor Martin with regard to scarifying the wound and administering stimulants, and, so far as they are not likely to be injurious, these means will probably continue to be followed as extra precautions. Dr. J. Ashburton Thompson, Chief Medical Officer of the Government Health Department of New South Wales, has issued specific directions for snake-bite treatment. He first advices the use of the ligature, which is to be loosened for five minutes after the first half-hour; then tied and screwed up again. At the end of the second half-hour the ligature may be removed altogether. Dr. Thompson, in continuing his directions, says:—"In places where a ligature cannot be tied, as on the neck or face, pinch up the bitten part between the finger and thumb, and cut it out. In any case the bitten part should be cut into by numerous little cuts over and around the bite, for about 1½ inches round, and sucked by the mouth freely and perseveringly; and this can be done without danger by any person. Stimulants, such as brandy, whisky, gin, rum, in small quantities at a time (a few teaspoonfuls), or strong tea or coffee or wine, may be given if the patient be faint."

The removal of the ligature as described is a very necessary precaution, for at least one case has occurred in Queensland where, through keeping it on too long, mortification set in, and amputation of the arm had to be resorted to.

Professor Krefft, in his work previously referred to, says:—"The whole treatment resolves itself into this: *Suck the wound, if possible, at once; apply a ligature; lacerate the punctures, and wash the part with water or urine; keep moving, and do not despond.* Half the number of fatal cases have resulted from fear, many persons having died simply because they lost heart, did not attempt to tie a ligature, or were afraid to lacerate the wound and suck it."

A Croydon paper some time ago published particulars of a case in which a cure had been effected by rubbing vinegar into the wound; but in this case the ligature was first applied and the wound scarified. The vinegar was used in consequence of the person treating the patient having seen an extract in the *Queensland Agricultural Journal* from an Indian paper, which described experiments successfully made with it on animals which had been bitten by snakes.

Mr. John Wilson, Brisbane, says that in Ceylon he was very successful in saving the lives of coolies who were bitten by cobras or tic-polangas when picking coffee. As soon as a man was bitten, a ligature was put on above the wound, then a pin was pushed through

SCOVELL'S ESTATE, BANGALORE: GENERAL VIEW

Vide Page 341.

the skin, a piece of twine was twisted round the projecting part of the pin and drawn tight. This raised the bitten part, which was cut off with a sharp knife.

The vinegar cure is described in the *Queeensland Agricultural Journal* in the issues of January, 1903, January, 1904, and February, 1905. Three authenticated cases of cure of snake-bite by the vinegar treatment have been reported to us since the first article appeared in the Journal.—Ed. "*Q.A.J.*"

SCOVELL'S ESTATE, BANGALORE.

(*Illustrated.*)

The practical solution of the problem whether English fruit could be successfully grown in the tropics is one which calls for a good deal of enterprise. In Ceylon we find grapes growing in Jaffna, peaches in Haputale, and pears and plums in Nuwara Eliya; while in Bangalore most varieties of English fruit are found to thrive. But, so far as we know, no serious attempt on a commercial scale has been made to raise such fruit under the most favourable conditions for their growth, and under the supervision of thoroughly qualified practical experts. We have heard of more than one Company or Syndicate started under apparently happy auspices, but in the end invariably languishing for the want of a proper water supply, for the lack of funds, for the need of a reliable expert, or some such reason. "Scovell's Estate" is rather a misleading designation for what is in reality a fruit farm situated 6 or 7 miles away from Bangalore Cantonment. The farm is about a hundred acres in extent, and during the last two years has been gradually planted up with different varieties of fruit-trees imported from Australia—such as oranges, grapes, apples, peaches, peas, apricots, &c.

In such a venture the two important elements are the selection of the site and the proper equipment of the farm. In both these respects Scovell's Estate has been most fortunate. As regards situation the place is a veritable "happy-valley," provided with an unfailing water supply, which is so utilised as to bring the entire area under a perfect scheme of irrigation. This excellent arrangement, though it has involved considerable expense, places the farm at an immense advantage.

The plantation itself is under the immediate supervision of a fruit expert of considerable practical experience, who is convinced that it is possible to arrest the tendency in tropical vegetation to grow continuously, and to induce a dormant condition so essential for the formation of fruit buds.

I had the privilege of visiting Scovell's Estate on the 17th of September last, and of being shown over the property by Mr. Scovell and his Manager, Mr. Meredith, both of whom seem to be quite satisfied with the prospects. If their anticipations are realised, there should be a great future for the cultivation of English fruit in Southern India, provided the same business acumen is available for selection and equipment; for with cheap labour and good prices in the East, there is no reason why the output should not successfully compete with the produce of Australia and other parts of the world.

The Farm is well worth a visit, and the best time for seeing it is about April, when most of the fruit under cultivation should be in season.

C. DRIEBERG.

Colombo, October 4th, 1911.

RIVALRY BETWEEN PANAMA AND SUEZ.

Rates will be Slashed in a War for the World's Commerce between the Two Ditches.

With the opening of Panama Canal there will be a slash in the rates in a war for the commerce of the world. According to latest advices the United States Government is preparing to begin business with a cut in the rates of 100 per cent. below the tolls charged by the Suez Canal.

An interesting article on the coming war for the commerce of the world appears in the Minneapolis Journal, and is of special interest at this time. The article follows:—

Competition between the Panama Canal and the Suez Canal is expected as soon as the former waterway is open to commerce. The United States Government realizes this, and is preparing for it. It is the intention, if Congress sanctions the step, to begin business at Panama at once with a cut of practically 100 per cent. below the tolls charged by the Suez Canal.

"That the Suez Canal will meet the cut is not doubted. That canal is owned by a private corporation, and without competition, it has been earning a gross revenue of upward of $20,000,000 a

year. But if the Panama Canal takes away any material share of the Suez business, Colonel Goethals has assured President Taft that the Suez Canal can come down to the proposed Panama rates and still declare dividends of reasonable size.

The idea of competition between canals on opposite sides of the Atlantic ocean may seem rather far-fetched, but the canal authorities of the United States Government explain it in a rational way. They say the North Atlantic is the harbour of the world's wholesale and manufacturing trade. The principal business of the world centres around the shores of that sea. The principal trade of the world runs into and out of the North Atlantic. That is where all the rest of the world comes for its goods, and it is the clearing-house through which it does its business and finances its operations.

Heretofore there has been but one chief gateway out of this centre of trade—that to the eastward through the the Suez Canal. But now there is to be a gateway to the westwerd as well through the Panama Canal. Hence the competition between the two gates must follow on all trade between North Atlantic ports and the other side of the world. The question of which will get the greater share of it is one solely of dollars and cents.

Colonel Goethals, the builder of the Panama Canal, who expects to throw it open to commerce in less than two years, has explained all this to President Taft during his present visit to Washington. It will not be a matter of sentiment, but purely one of which canal and which route will enable the ships to deliver their cargoes at the lesser expense,

The Suez Canal at present charges a toll of about $1·70 per net registered ton American money and American measure. From the attitude of both the President and of Colonel Goethals, it is inferred that they will advocate a charge at Panama of not more than $1 per net registered ton, and possibly less than that. What they would like to have Congress do is to give the President authority to fix the rate at anything between 50 cents and $1·50 a ton, so that he may be able to decide upon a figure finally that will permit the Panama Canal fully to meet its operating expenses, there being no evidence of intention to try to make money out of it. Of course, these rates refer to world traffic, and not to American ships, as the right is always retained to let American vessels use the canal toll free if that shall be deemed best.

AN ACCOUNT OF THE WORKING OF THE LAND SETTLEMENT SCHEME IN ST. VINCENT.

BY W. N. SANDS,
Agricultural Superintendent,
St. Vincent.

(From the *West India Bulletin*, Vol. XI., No. 3, 1911.)

The Land Settlement Scheme of St. Vincent is probably the largest and most comprehensive of its kind yet attempted in any of the British West Indian Colonies, so that an account of the working of it during the past ten years, more particularly from an agricultural standpoint, may be of interest.

The scheme owes its existence to the West Indian Royal Commission of 1897. The Royal Commission, after going very fully into the condition of the peasantry of St. Vincent, reported as follows, in paragraphs 374-8 of their report:—

374. We have already made a general recommendation that the settlement of the Creole population of the West Indies as cultivating proprietors should be recognized as the settled policy of the Government of the different Colonies, and we see no reason to depart from that policy in the case of St. Vincent. On the contrary, it seems to us that, whether the sugar industry is maintained or disappears, it is absolutely essential in the interest of the native population that their settlement of the land should be facilitated; in no other way does it seem to us to be possible to maintain even the most moderate degree of prosperity in St. Vincent.

375. At the same time the question is surrounded with special difficulties in the case of this island. There is, no doubt, a large extent of Crown land, but this land is situated in the centre of the island, at a considerable elevation, remote from the markets, and is unprovided with roads. A great deal of the land consists of steep slopes difficult to cultivate, and liable to suffer from heavy rains and floods.

376. The attempts that have been made in recent years to settle cultivators on the Crown lands have not so far met with much success. A considerable number of plots were taken up, to be paid for in instalments, but the owners complained of the want of roads. They have suffered from the low prices of produce, and owing to the general depression they have found themselves unable to get work so as to earn the wages on which they relied in some

degree to pay for their holdings. In 1896 many of these holdings were damaged by floods, to an extent which has made it difficult or impossible for the purchasers to pay the instalments due, whilst much of their cultivation has been swept away. Whether the attempt to settle the population of the Crown lands under such condition ultimately proves successful or not, we are convinced that it does not afford any prospect of providing in sufficient time for the bulk of the population likely to be thrown out of employment by the stoppage of the sugar-cane cultivation, and we are doubtful whether it is expedient to reduce largely the area of the central forests; a reduction which is inevitable if the lands are occupied by settlers.

377. There are, however, round the sea-coast thousands of acres of fertile land in the hands of private owners uncultivated and likely to remain so. The holders of the lands appear to be unwilling to sell them in small lots or at a reasonable price, and are unable to cultivate them. Under the circumstances we have no hesitation in recommending that suitable portions of these lands be acquired by the State and made available for settlement in small plots. If suitable lands cannot be obtained by private agreement with the owners, powers should be taken by the Government to expropriate them on payment of reasonable compensation. The condition of St. Vincent is so critical as to justify the adoption of prompt and drastic measures of reform. A monopoly of the most accessible and fertile lands by a few persons who are unable any longer to make a beneficial use of them cannot, in the general interest of the island, be tolerated, and is a source of public danger.

378. The determination of the particular lands to be acquired by the State, and the detailed arrangements to be made for settling proprietary cultivators on them must be left in the hands of those who possess greater local experience than we can pretend to. The cost of such a measure will be considerable, but need not be very heavy. We see no likelihood of the Colony of St. Vincent being able to meet it, and we recommend that it be borne by the Imperial Government.

It will be seen that a very critical state of affairs existed in 1897, which was greatly intensified by the effects of a disastrous hurricane in the month of September of the following year.

Acting on the recommendations of the Royal Commission, the Imperial Government made a Grant-in-aid of £15.000 to the local Government, for the purpose of purchasing estates and settling the peasantry on them; but before the grant could be utilized it was found necessary to pass an Ordinance to authorize the acquisition of estates. This ordinance was known as the Land Settlement Ordinance, 1899. Under it, power was given to the Governor-in-Council to select, purchase, and take possession of lands; to appoint a Land Commissioner and other officers; to make regulations for carrying into effect the purpose of the Ordinance; and for regulating the system of establishing and locating small holders on land acquired under its provisions.

During the year 1899 several estates in different parts of the island were acquired, namely, Cumberland Valley, 1,470 acres; Linley Valley, 1,571 acres; New Adelphi and Park Hill, 1,101 acres; Richmond Hill, 285 acres; and Clare Valley-Questelles, 633 acres. The total area of these was 5,060 acres. As soon as possible after the estates were taken over, the lands were surveyed and split up into a large number of small holdings. The area of the larger number of holdings averaged 5 acres. There were 633 of these, but there were also 82 having an area of about one acre each. Reserves were made (*a*) of half a chain around the sources of important streams, (*b*) of exposed ridges and such forest as was considered necessary for forest conservation, (*c*) of land necessary for public purposes, such as sites for churches, chapels and schools, (*d*) of land required for roads and paths, and (*e*) of land for townships.

The total cost of acquisition, including legal and survey fees was £14,706. The value of each small holding was apportioned, so that the total valuation should be equal to the total amount of the expenses incurred by the Government in the purchase of the whole area, plus interest at the rate of 3 per cent. for twelve years. Each applicant was required to pay 25 per cent. of the value of a small holding before being allowed to occupy it. The balance of the value of the land was divided up into twelve equal parts; one had to be paid before the expiration of the fifty year from the date of the provisional permit to occupy the lot, and the remaining parts by annual instalments, so that each small holder was allowed sixteen years to complete the purchase of his land. A steady and industrious applicant, who was not able to pay 25 per cent. of the

value of a small holding at once, was allowed to occupy the land on his agreeing to pay the amount in four successive annual instalments, the first to be paid before the expiration of one year after the date of the permit to occupy the lot, and the balance of the value in the manner described above. The conditions of tenure stipulated that each small holder should reside on his holding, or on a house spot in one or other of the townships which were formed unless he had been granted permission by the Governor-in-Council to reside elsewhere. There were other conditions, but the one of chief interest from an agricultural point of view read as follows :—

Every purchaser shall carry out such instructions as to the area of cultivation, the nature of products to be planted in a particular spot, the manner in which the land is to be cultivated and the products cared for, and the handling of the products for market as may from time to time be given to him by the Officers of the Imperial Department of Agriculture for the West Indies.

The introduction of the new scheme was not received with favour by some estate owners, for they anticipated that there would be a serious shortage of labour by settling such a large number of people on the acquired lands, and they were also of opinion that the peasants would become so independent of ordinary estate work that it would not be possible for them (the estate owners) to carry on their cultivations in a profitable manner. On the other hand there was a good deal of dissatisfaction and suspicion among the peasants themselves, and at first the action of the Local Government was much criticised. Some of the peasants thought, in view of the fact that the Imperial Government had made a grant for the purchase of lands, that they should not be called upon to pay for the holdings; others thought that the Government would retake the lands after they had put them into cultivation. Some would not accept free supplies of useful plants for the same reason. The eruptions of the Soufriere in 1902 also had a demoralizing effect, and it was difficult to get some of the small holders to pay their instalments. There were other difficulties which had to be met at the outset, but happily most of them have long since been surmounted.

The administrative and financial sides of the scheme have been controlled by the Land Commissioner. Financially it has proved a success, for the Land Commissioner was able to report on March 31, 1910, that there was £7,964 to the credit of it, notwithstanding that no less than £6,572 had been spent on roads and by-ways, wages, resthouses for officers, wind-breaks, awards and prizes to small holders, etc., in addition to the cost of acquiring the estates. The amount expended on roads and by-ways alone totalled £3,781. Quite recently the operations of the scheme have been extended by the purchase of Union Island, containing 2,600 acres of land for £5,000, and at the present time the Government is in treaty for 400 acres of Fair Hall estate near Calliaqua. As soon as the surveys are completed, the peasantry will be allowed to purchase lands for small holdings at those places, on somewhat similar terms to those laid down in the original regulations.

On March 31, 1910, it was further reported that there were fifty lots with a total area of 272 acres on hand. These lots are for the most part in places where it is difficult to get access to them; besides, a number have land too poor and steep for profitable cultivation. For lots that are favourably situated in regard to roads, and where the land is not too difficult to work, there is keen competition at the present time.

The foregoing is a brief outline of the scheme and its present position.

The efforts of the Agricultural Department have been chiefly directed to the instruction of the small holders in the best manner of cultivating their lands and crops and preparing their produce for market; besides, the Department has annually raised and distributed many thousands of useful plants and seeds to them, free of cost.

In order that the Department might keep in close touch with each small holder and see that the instructions given are carried out, an Agricultural Instructor was appointed, whose duties are chiefly concerned with the Land Settlement estates. He is required to submit a monthly report to the Agricultural Superintendent for transmission to the Administrator and Imperial Commissioner of Agriculture. This report gives an account of the estates visited; the condition of crops; instructions given to small holders; the number of economic plants distributed; the progress made with the making and ultilization of manure and compost; and any other information likely to be of interest. His work is supervised by the Agricultural Superintendent, who pays periodical visits of general inspection. A small holder who refuses to

carry out instructions, or who neglects his holding, is first of all warned that unless he gives his land and crops the necessary attention his holding will be forfeited. Should he persist in his neglect, a recommendation for the forfeiture of his holding is submitted by the Agricultural Superintendent to the Administrator. Fortunately, it has only been found necessary to forfeit a few small holdings for this reason.

The estates, with the exception of Clare Valley-Questelles and Richmond Hill are situated in mountainous districts and extend for a considerable distance inland. There is very little level land, but the cultivable area is fairly well worked by the small holders.

The principal crops grown are cotton, ground provisions, arrowroot, cassava, cacao, ground nuts, pigeon peas, Indian corn, sugar-cane, plantains and bananas. A considerable proportion of several of these crops is annually exported to neighbouring colonies. The cotton, however, is nearly all sold to the Government, or to local dealers, for export to the United Kingdom, Besides growing these crops for export and local use, the people rear a large number of cattle and small stock of their lands to send to other islands for sale.

Although it is not possible to ascertain correctly the quantity of the output from the Land Settlement estates, it may be taken for granted that a large proportion of the exports shown in the following list came from them. The items and values are taken from the official Blue Books of the past five years.

LIST OF EXPORTS OF GROUND PROVISIONS, SMALL STOCK, ETC., 1905-6 TO 1909.

Year.	Articles.													Total.
	Sweet Potatoes.	Tanias.	Yams.			Ground Nuts.	Farine.	Plantains.	Fowls.	Eggs.	Goats.	Pigs.	Sheep.	
	bags.	bags.	Bags.	Brls.	Number.	Baskets.	lb.	branches.		doz.				£.
1905-6.														
Quantity	9,554	2,551	1,735	150¼	7,334	9,918	88,789	2,087	1,550	442	3,220	2,288	768	
Value £	1,949	708	...	...	687	2,445	378	104	76	11	888	1,538	384	9,168
1906-7.														
Quantity	5,560¾	2,557¾	1,856½	77	8,605	7,684½	64,478	2,160	2,064	1,122	2,891	2,186	468	
Value £	1,118	705	...	...	650	1,929	286	107	105	28	824	2,186	236	8,174
1907-8.														
Quantity	4,803	1,719	1,035½	186	8,346	6'360	40,764	1,088	1,527	1,794	2,451	1,575	601	
Value £	1,044	507	...	...	521	1,589	174	57	77	49	678	1,569	296	6,561
1908-9.														
Quantity	6,418	2,320	1,232	121¼	13,878	8,869	76,271	1,858	1,814	3,192	1,973	1,573	524	
Value £	1,361	613	...	...	423	1,740	328	98	87	73	525	1,564	211	7,024
1909.														
Quantity	5,199¼	2,334 8½ casks	1,909¼	109¼	8,308	5,815½	47,900	572	2,360	4,170	2,437	1,563	638	
Value £	1,070	671	...	...	673	1,480	229	29	117	104	676	1,563	319	6,931

By far the largest acreage is cultivated in ground provisions, but a fairly large area is planted in cassava for making farine and cassava starch. Among other crops are Indian corn, pigeon peas and ground nuts. It is a fortunate circumstance that the small holders have found a ready market for their surplus produce in Trinidad, Grenada and some of the Grenadines. In Trinidad, also, there is a good market for small stock and poultry, while Barbados takes a large number of cattle in each season. These intercolonial markets are within easy sailing distance of St. Vincent. It is undoubtedly due in no small measure to the fact that the small holders have been able to dispose of large quantities of ground provisions and other produce and stock at fair prices in these intercolonial markets, that the scheme has proved a success. Had there been no such outlet, it is likely that a large number of them would have had to eke out a hand to mouth existence, and besides, would not have been able to pay for their lands. There is, however, much room for improvement in the methods of shipment to, and the disposal of produce and stock in, other islands. The small holders often have to place their shipments in the hands of the captains or stevedores of the sloops and schooners plying between the islands.

Some of these men do not always deal fairly with the people, and it is no uncommon thing for sums to be paid which are far below those actually realized. It should be possible to put this intercolonial trade on a better footing, provided that the small holders could be got to work together on co-operative lines. At the present time, however, the cultivation of cotton is being rapidly extended, which circumstance, with the possible increase, also, of arrowroot planting will no doubt lead to a reduction in the area cultivated in ground provision crops. With a smaller output and an increase in the local demand, it appears unlikely that those who continue to grow ground provisions will have to rely so much on the intercolonial markets in order to dispose of their crops at a profit.

Arrowroot is another product which is produced on a fairly large scale on some estates, more particularly New Adelphi and Park Hill, and is shipped to neighbouring colonies. At New Adelphi the Government has erected a central arrowroot mill to assist the growers there, but on several of the other estates there are small mills owned and worked by the holders themselves. The arrowroot industry has for many years been in a depressed condition; so much so, that neither the estate owners nor the peasantry of the island have been able to obtain paying prices for the starch, but recently an Arrowroot Growers' and Exporters' Association had been formed, to which nearly all the owners of private estates belong. The members of the Association have agreed not to sell arrowroot in the United Kingdom below 2*d*. per lb.—a figure which allows a fair profit to be made. One result of this is that the price now being obtained for arrowroot in the intercolonial markets is higher than the average price previously realized. Taken altogether, the outlook for arrowroot at the present time is much brighter, and it appears likely that its production will prove more remunerative in future than it has been for several years past.

Sugar-cane is grown chiefly at New Adelphi; here a sugar mill is also maintained by the Government. A small charge of 2*s*. per barrel of sugar and 1*d*. per gallon of syrup is made to the people for the use and upkeep of the works. These comprise an old muscovado sugar plant, and the loss of sugar through defective crushing of the cane, and in the handling of the juice is considerable; still, the system of manufacture is one which the small holders understand fairly well. It is doubtful the industry has proved very remunerative, however during the past three or four years owing to the extension of cotton planting throughout the island, and the consequent reduction in the acreage planted in sugar-cane. The producers at New Adelphi have been able to dispose of their sugar and syrup, locally, at fairly good prices.

From the time the scheme was started it was thought desirable to encourage the small growers to establish permanent crops on portions of their lands in order that they might not have to depend so much on ground provision crops, sugar and arrowroot, and with this object in view, as has been mentioned before, a large number of cacao and other plants, but chiefly cacao, have been annually raised by the Agricultural Department and distributed free to them.

In order to ascertain the progress made, and to inspect the condition of the permanent economic plants cultivated, the Agricultural Superintendent made a complete tour through the districts toward the end of 1906, and the following extracts are taken from a report submitted by him to the Administrator:—

The chief permanent plant cultivated is cacao. Other permanent types grown in small numbers are coffee, nutmegs, coconuts, and cinnamon, but they do not form an important feature, and the produce is practically all consumed locally.

When the estates were acquired by the Government, a number of established cacao trees were already growing on them, more particularly on those in the Linley and Cumberland Valleys. The total number of trees was probably about 6,250, but many were in an unsatisfactory condition. Since 1900, the Imperial Department of Agriculture has encouraged the planting of cacao in places where it was thought it would do well. The Agricultural Instructor has selected suitable lands, and the small holders have planted them up according to instructions given.

The Agricultural Department's nurseries for raising cacao and other plants were situated at the Botanic Station and the Georgetown Experiment Station. Besides, small nurseries have been formed in the Linley and Cumberland Valleys for raising plants for the small holdings there. The latter were maintained from Land Settlement funds. In addition to the plants raised by the Department, a good many have been raised by the small holders themselves and planted out on their lands.

As a result of the tour of inspection, it is estimated that the number of cacao trees and plants now growing on the estates in good or fair condition is fully 60,000, the larger portion of course being young plants.

The total amount of cacao produced at the present time on each estate has been carefully estimated with the following results:—

Estate.	Number of bags of cacao produced.
Linley Valley estates ...	30
Cumberland Valley estates ...	15
Clare Valley and Questelles...	—
Richmond Hill	3-4
Park Hill	3
New Adelphi	1½
Total	52½-53½

It will be observed that the total estimated output of cacao is from 52½-53½ bags. With the exception of Clare Valley and Questelles, a progressive annual increase in yield is to be looked for from now onwards.

The area of the small holdings varies from 1 acre to 7½ acres. The number occupied at the end of the year was 584. Cacao-planting has been attempted on portions of no lesss than 369 with varying success. Some of the people have put in just a few plants and others a considerable number.

In order that an idea may be formed of the progress, or otherwise, made on the estate, a brief summary of each has been worked out. The condition of the trees and plants has been classed under three heads as follows:—

'Improved' means that the trees are making good progress, are well cared for, and that in most cases the cultivtion has been extended.

'Fair' means that there is in the cultivation approximately the same number of trees as in 1904 when the census was taken, and that they are not making much progress.

'Poor' means that the trees are in poor condition through being planted in unfavourable situations or not well cared for.

The numbers in the summary are based on the figures given in 1904, as no later census has been taken.

GENERAL SUMMARY REGARDING ALL THE LAND SETTLEMENT ESTATES.

Estate.	No. of cacao plants improved.	No. of cacao plants fair.	No. of cacao plants poor.
Park Hill ...	2,180	2,616	1,074
New Adelphi ..	2,793	1,784	961
Richmond Hill ..	3,475	698	1,014
Clare Valley and Questelles ..	3.422	875	2,164
Cumberland Valley estate ...	9,437	3,026	6,147
Linley Valley estates ..	16,465	4,873	8,976
Total ..	36,402	13,272	20,436

The total number of plants in an 'improved' and 'fair' condition on all the estates, as shown in the list, is 49,674 as against 20,436 'poor.' In proportion to the total number of plants growing Park Hill and New Adelphi show the best record of progress, although estates such as Rosebank and Belmont in the Linley Valley group would show a still better record if taken separately.

The progress made with the planting of permanent economic plants during the past few years has been considerable, notwithstanding that at the outset many difficulties were experienced.

Since 1906 work has been continued on much the same lines, and it is estimated that the quantity of cacao now produced annually is nearly double of that grown in 1906. The chief increases in yield have been obtained in the Linley Valley and at Park Hill; here there are some excellent cultivations giving satisfactory returns; on all the estates, however, with the exception of Clare Valley-Questelles, fair progress has been made.

The following table shows the number of economic plants raised and distributed by the Agricultural Department free to small holders during the past ten years:—

Year.	Economic plants distributed.
1900	5,660
1901	7,679
1902-3	402*
1903-4	5,325
1904-5	15,424
1905-6	11,770
1906-7	6,209
1907-8	3,325
1908-9	4,321
1909-10	3,804
Total	63,919

Of the above total, no less than 53,000 were cacao plants.

With seed of good types of cacao now available on all the estates, small holders are able to raise their own plants, so that it has not been found necessary to continue the maintenance of nurseries

* Year of eruption of Soufriere.

at Georgetown and the Linley and Cumberland Valleys; the nursery at the Botanic Station has, however, been maintained.

The Agricultural Instructor has continued closely to watch the cultivations and give advice and instruction to the growers in regard to manuring, pruning and other matters, and his assistance is now much appreciated.

The progress made with cacao cultivation may be said to have been somewhat slow; still it should be mentioned that, under local conditions, cacao is rather a difficult crop to grow. The soils are, as a rule, too light and shallow, and it is only in sheltered places where there is a good depth of rich soil, and the rainfall is not excessive, that cacao thrives. Again, the small holders lack capital, and there have been no means by which they could obtain loans at a low rate of interest to establish cultivations; besides, they have not forgotten the disastrous hurricane of 1898, which destroyed nearly all the cacao plantations in the island. Under these circumstances, it is not to be expected that many of them, even if they had the money, would care to incur the expense and take the risk of planting, on any considerable scale, a crop which takes about seven years to reach a paying stage, since they are able to raise crops which give a quicker and more certain return on their outlay and for their labour.

From the experience gained, it is not considered desirable that the Agricultural Department should insist on any large extension of cacao planting, but should rather endeavour to induce the small holders to practise more intensive methods of cultivation of the plots that are already established and are promising well.

Excellent progress has been made with the cultivation of Sea Island cotton as an annual crop at Clare Valley-Questelles and parts of the Linley Valley and Richmond Hill estates. On these estates there are open lands near the coast. Unfortunately, the lands of the other estates are not suitable for cotton cultivation, so that the area available is limited.

Although the industry was introduced in 1903, it was not until 1906 that a serious attempt at cotton-planting was made by the small holders. In that year 48 acres was planted, but since there has been a progressive annual increase in the area cultivated, which during the present season has reached 290 acres. Of this total, Clare Valley-Questelles is represented by no less than 236 acres, and it is on this estate, therefore, that most progress has been made.

The details for the several years are as follows:—

Season.		Area of cotton planted, Clare Valley-Questelles. Acres.
1906-7	...	11½
1907-8	...	50
1908-9	...	96½
1909-10	...	151
1910-11	...	236

The yield per acre for each season has been satisfactory. This is in no small measure due to the advice and instructions given by the Agricultural Instructor in regard to the crop.

It is estimated that the value of the present season's cotton crop grown on the Land Settlement estates will exceed £2,000, or an all-round gross value of over £10 per acre.

During the last season the Government inaugurated a system whereby seed-cotton is purchased from small growers throughout the Colony on a profit-sharing or co-operative basis at the Government Cotton Ginnery. This has had an excellent effect, for besides ensuring that growers get a fair market price for their cotton, it induces them to put forth their best efforts in the cultivation of their lands, and has led to an extension of cotton-planting.

The system of purchasing cotton may be briefly described as follows:—

Seed-cotton brought for sale is first of all graded, and then a price is paid which is equal to one-fifth of the estimated value of the lint, less 2c. per lb. to cover freight and other charges. For instance, if the market value of first grade white lint is 37c. per lb., the price paid for seed-cotton is 7c. per lb. The seed is not returned to the grower, but retained to cover the cost of ginning and baling the lint; but should the proceeds of the sale of the seed exceed 1c. per lb., the amount of the excess is added to the bonus distributed at the end of the season. The bonus distributed has been equal to four-fifths of the net profits made.

This is calculated on a percentage basis on the amount paid on account to the growers. For example, if £1,800 is paid on account for seed-cotton, and at the end of the season it is found that the net profit made by the sale of lint and seed is £450, the amount available for distribution would be £360, which is equal to a bonus of 20 per cent. or 4*s.* for every quantity of seed-cotton sold worth £1.

The successful results already obtained under this system by the peasantry have ensured that a much larger acreage will be planted in cotton on the Land Settlement estates during the coming season.

Besides dealing with questions concerning the best manner of growing and handling different crops, the question of maintaining the fertility of the lands of the small holdings has received, and continues to receive, a good deal of attention on the part of the Officers of the Agricultural Department, and it is gratifying to note that very satisfactory progress has been made.

The small holders have had to be constantly instructed in the making of drains to prevent washing, the formation of compost heaps and manure pens, the growing of leguminous and other plants for green dressing purposes the utilization of grass and bush as a mulch for permanent crops and for arrowroot, the rotation of crops, and in pasture following. Further, in order to prevent waste of valuable organic matter, the burning of bush, except with the permission of the Agricultural Instructor, has been strictly prohibited.

Although a large measure of success has attended the efforts made with Land Settlement at St. Vincent, and most of the difficulties which presented themselves at the outset have been surmounted still, when looked at to-day in the light of past experience, the scheme appears to be somewhat incomplete. Had it been possible to arrange agencies for the disposal, on co-operative lines, of the produce and stock of the small holders, and to form co-operative credit banks on the Raiffeisen system on the different estates, the scheme might have proved an even greater success.

In most countries where plans for the settlement of the people of the land are being carried out, these matters have received a great deal of attention; but whether success would have attended local efforts in this direction at the commencement of the scheme it is not possible to say, as the circumstances of the small holders now are quite different from those of ten years ago.

During the past two years, as was previously mentioned, the Government has successfully introduced a system for the purchase of cotton on a profit-sharing basis, but it is questionable if it would be wise to extend the system further so as to include other products, owing to the large amount of extra work and responsibility that it would involve. It should rather be left to the people themselves to form co-operative agencies for the purchase and sale of their produce, the Government of course giving all possible help and encouragement. At the present time agencies might be started for dealing with such products as cacao, arrowroot, cassava starch and ground nuts.

A few months ago, a small number of the better class of small holders at Clare Valley-Questelles formed an agricultural credit bank, and suitable rules embodying some of the best features of the Raiffeisen system were drawn up. The Government, in order to start the bank on a sound business footing, made a loan of £25 at 5 per cent. interest per annum. Should this pioneer bank prove a success it is likely that others will be started in different districts on similar lines.

It will be seen that serious efforts have recently been undertaken to make the scheme more complete, and it is hoped that success will attend them.

CEYLON AGRICULTURAL SOCIETY.

PROGRESS REPORT LVI.

MEMBERSHIP.

Since the meeting of the Board held on 14th August, the following have become members of the Society:—C. J. Owen, W. G. Bayley, William Gibson, H. Woltersdorf, E. G. Adamaly & Co., P. Alfred L. Dias, Henry A. Perera Mudaliyar, Camora Municipal (Margoa), H. A. McMillan, Bosanquet & Co., J. D. Finch Noyes, A. H. Taylor and A. St. V. Jayawardene.

STAFF.

Messrs. P. B. M. Bandaranayake and M. J. A. Karunanayake have been appointed as probationary Agricultural Instructors.

Mr. N. Wickremaratne, last stationed at Kegalla in connection with a special programme of work for that district, was sent to Pusa Research Institute for a training in lac culture. Mr. Wickremaratne has already entered upon his training under Mr. Misera, the lac expert, and should be back in Ceylon by the end of the month with a stock of brood lac for inoculating purposes. He has already sent out a stock of brood for *Zizyphus jujuba* (Sin., Masan) which appears to have travelled well.

INSPECTION TOURS.

The Secretary paid a visit to Matara and Hambantota before going on a month's leave spent in Bangalore.

Mr. Chelliah reports a very busy time in the North among the cultivators, who have started work with the rain which was so anxiously awaited. He is giving special attention to growing cotton in chena lands in outlying districts, such as Pooneryn.

Mr. L. A. D. Silva has been deputed to work in the Sabaragamuwa Province, which has been very badly served by the drought. His suggestions for assisting the poorer cultivators are receiving attention; and seeds asked for by the Government Agent will be sent as they become available. During September he visited Hatella, Ematiyagoda, Godakewela, Warayaya, Hanwane, Kottimulwela, Belimalliyadde and Balangoda.

Mr. Wickremaratne visited Dedigama, Pinnawela, Pindeniya, Kottapola, Wakirigala, Beddewela, Mawanella, Balalla, Ambepussa, Galapitamada, Kahambiliyawela, Undugoda, and Kehelwatugoda, and before leaving for India he was engaged in planting Pinnawela and Dedigama Experimental Gardens with fruit trees and vegetables. He also initiated experiments in paddy growing by transplanting at two centres, and held a ploughing demonstration at Kehelwatugoda.

Mr. Molegode, Agricultural Instructor for the Central Province, visited the Badulla district and was engaged in holding meetings and ploughing demonstrations at different centres. At Timbirigaspitiya a ploughing demonstration was held, arranged by Bibile Ratemahatmaya, who was present with the headmen and paddy cultivators to see the working of the Empire plough. The Ratemahatmaya has ordered a number of ploughs for lending to villagers. Mr. Molegode's interesting report on his itinerary will be published in full in the Society's Magazine.

Mr. Sathasivam has been devoting most of his time to assisting in the cultivation of cotton in chenas. He has also started work in an Experimental Garden at Tampiluvil. He reports that about forty light iron ploughs are now in use in his district.

Mr. Jayasuriya visited Boralupola, Madurawela, Renuwana, Yalagala, and held ploughing demonstrations wherever it was possible; some of the demonstrations had to be postponed owing to the fields being flooded by rain water.

Messrs. Bandaranayake and Karunanayake, probationary instructors, are undergoing a special training at the Experiment Station at Gangoruwa and the Government Stock Garden, and will be sent out into the provinces after a term at Mahailuppalama.

BRANCH SOCIETIES.

The Dumbara Branch is at present chiefly occupied with its experiment in growing Sumatra tobacco under the supervision of Mr. Valabane.

The Wellaboda Pattu (Galle) Branch, at a recent meeting, elected new office-bearers, and appointed Messrs. J. H. Siriwardene and C. D. S. Wickremasuriya and the Secretary (Mr. W. de Livera) a Committee to make a repot on the Experimental Garden conducted by Mr. N. A. S. Jayasuriya at Weragoda, where excellent work is said to be going on.

The Magampattu Branch recently held a meeting to consider what steps should be taken to assist the cultivators who have suffered so much by the failure of seasonal rains, as a result of which the extensive fields at Tissa have failed to mature their crops. A resolution was unanimously adopted at a meeting presided over by the Assistant Government Agent that an appeal be made to the Parent Society with a view to obtain the loan of a sum sufficient to purchase seed paddy for the next cultivation. A fund started at the meeting was liberally supported, and the Finance Committee of the Board has the question of loan under consideration.

SHOWS.

In addition to a Special Committee in connection with the All-Ceylon Exhibition of 1912, referred to in the last Progress Report, an Executive Committee to deal with all details connected with the Exhibition has been formed, consisting of the following members:—

The Hon'ble the Colonial Secretary
The Director, Royal Botanic Gardens,
The Chiarman, Chamber of Commerce
The Hon'ble Mr. Solomon Seneviratne
The Hon'ble the Government Agent, W. P.
Mr. E. B. Denham
Mr. H. F. Macmillan
Mr. W. Arthur de Silva, and
The Secretary.

The Catalogue of the Exhibition is now under the deliberation of the Special Committee, and will be published shortly.

A market show was held at Dedigama on the 19th August, which was well patronised in spite of the drought and sickness in the district. A fuller report of this Show will be given in the Agricultural Magazine.

PADDY (RICE) CULTIVATION.

Small consignments of Rascadam, Badshabog, and of Carolina Golden Rice from the U. S. A. are under experiment in suitable centres.

Cultivation by transplanting is carried on at various places under the supervision of the Agricultural Instructors.

Referring to new ploughs, Mr. Molegode, Agricultural Instructor, writes :—"I am of opinion that the 'Goiya' plough (imported by Messrs. Hunter & Co.) is suitable for most lands. At Uva it has created quite a favourable impression."

COTTON.

The British Cotton Growing Association sent through their local agents a cwt. of cotton seed known as Sakellarides, and in advising despatch reported :—

"Last season in Egypt a planter there raised a very excellent type of cotton, which competed with the Sea Island varieties, and realized prices from 15*d.* to 17*d.* per lb. The cotton has not the same lustre and fineness as the Sea Islands, but is very strong, and altogether a useful cotton. In view of the fact that Sea Island Cotton did well in Ceylon, it has occurred to me that it might be useful if you could have some experiments carried out with this class of cotton, and therefore we are sending a bag of this seed to our Agents, Messrs. Freudenberg & Company, and asking them to hand the same to you. We shall be very glad to learn the result of any experinent you may decide to make with this seed. The name of the successful planter was a Mr. Sakellarides, and the seed is named after him, so that it is now known as "Sakellarides" seed. We might also mention that the Imperial Department of Agriculture for the West Indies are undertaking experiments with this variety."

The seed has been distributed to all likely places and is being tried in the Experimentnal Gardens conducted under the supervision of the Society's Instructors.

The following report on the Cambodian cotton grown at Balalla Experimental Garden has been received from the Director of the Imperial Institute :—

"Lint fairly soft, lustrous, of pale cream colour and almost free from stains. Strength generally fairly good, but some portions weak. Length of fibre from 1 to 1·2 inches; mostly from 1·1 to 1·2 inches, commercial valuation nominally 7*d.* per lb., with middling American at 7·39*d.* per lb., and fine machine ginned Broach at 7½*d.* per lb. The colour is of good quality; it is somewhat fine and softer than samples of Cambodia cotton recently received at the Imperial Institute from India, and it resembles an American Upland type. Such cotton would be readily saleable in the United Kingdom."

Mr. J. B. Ratnayake, of Wauwa, Hambantota district, sends the following interesting report of a trial of growing Sea Island cotton. The experiment was unfortunately begun at the wrong season, but its lessons are not without interest :—

"Three acres' extent of land was prepared for cotton cultivation in February, 1910, but for want of rain the planting had to be delayed till the 14th May of that year, when there was some rain. Dry weather set in again shortly after planting, and only about two-thirds of the seeds planted germinated. Fresh seeds were planted on 16th June to replace the failures and watered for five days. Of the three acres' extent two were cultivated in the manner of chena cultivation and one acre on ridges, according to instructions. There was no difference in the growth in the two methods. Some of the trees grew up to about eight feet high, but they bore less than those of the shorter growth. During the first two months after planting there was little rain, but the plants came up vigorously. The first picking, which was done in October, gave six hundred and seventy pounds of seed cotton. Twenty-five days later the cotton was ripe for a second picking; but, owing to excessive rain, the flowers and pods fell off and the fibre of those that remained were hopelessly damaged, and only eleven pounds of seed cotton were collected. The third picking commenced about the beginning of February last, and five hundred and sixty pounds of seed cotton have already been collected, and about one hundred pounds more could be picked from the trees of the second planting. There was dry weather during this picking, and the colour of the fibre was superior to that of the first and second, but its length was somewhat shorter.

"Samples of the stained and unstained cotton were sent to Messrs. Freudenberg & Co., Colombo, and they have valued them at seventy-five cents to one rupee and fifty cents per pound of lint. During the wet weather maggots and small beetles of pink colour appeared on pods, which affected the colour of the fibre to a great extent; but, as soon as the rains ceased, they disappeared; nevertheless a bug-like fly brooded in vast numbers, but these insects did not do much harm to the crop. I got rid of them by the application of naphthalene to the cotton collected. The cost of cultivation of the two acres of chena land was

Rs.42, and the acre planted on ridges Rs.26, the three pickings cost Rs.18. This variety of cotton appears to be suitable for this District, where I have tried it in many places on a small scale, but since there has been much variation in the rainfalls during the past few years; it is difficult to specify a definite period for its planting. However. I am of opinion that the North-east Monsoon is the best for its cultivation, as the maha rains usually last during three months followed by dry weather, when the maturity of the pods take place. Of all the places where I experimented, the cotton plants that were grown in Marakada division gave the largest yield, though the trees did not grow up high. This division is about the driest in the district. There are vast chena tracts in this division which are only under chena cultivation. Each tract has its own tank. There is reason to believe that these lands, or even portions of them, were cdltivated with paddy in ancient times. By restoring these tanks cotton could be easily cultivated here independent of the rainy seasons. If the product could be sold on the spot, it is probable that almost all the villagers would take to its cultivation, as the land on which cotton is cultivated could be utilized for fine grain cultivation once every other year, whereas, at present, chenas are cultivated once in five or six years because no jungle would grow up before such time on the land."

TOBACCO.

The position as to the experiment in tobacco cultivation at Mahailuppalama is dealt with in the papers submitted to the meeting, consisting of a Report by the Chairman of the Tobacco Committee, the Resolution adopted at the last meeting of the Tobacco Committee, and remarks by the Superintendent of the Experiment Station at Mahailuppalama. With regard to the suggestion of the latter that work be continued without interruption, the Committee are of opinion that future operations must be under the supervision of a Scientific Expert, and that the Society should incur no further expenditure at present.

The following report has been received from the British-American Tobacco Co., Ltd., on samples of Sumatra and Java tobacco grown in Ceylon :—

"In the absence of Mr. Hignett, I have pleasure in writing you regarding the samples of Sumatra and Java Tobacco grown in Ceylon, and referred to in your letter of 7th June, addressed to Mr. Hignett.

"We have taken the matter up with an expert and gone through the samples with him, and he has also made some cigars from the tobacco you sent. In his opinion, the tobacco, whilst it contains a few fair leaves, is chiefly of a very heavy, oily description. This trouble, however, could perhaps ultimately be overcome by finding the right seed, and the right soil in which to cultivate it.

"The greatest objection, however, to this tobacco, for use in cigar manufacture is, that it does not burn freely. Tobacco, to be used for cigars, must not only burn freely in the leaf, but further, when it is made up into cigars, it must also burn easily and hold fire, giving a white ash when used as a wrapper only, the ash should be perfectly white.

"Cigars made up from the samples you have sent will not burn properly, and there is no doubt that the leaf has been grown in unsuitable soil, and from what can be seen of the leaves submitted, the expert is of opinion that the soil they have been cultivated in would be more suitable for producing tobacco of a type desirable either for the pipe or cigarettes, but of this we cannot express any opinion.

"Further, this tobacco has a 'soapy' feeling, whereas, as a rule with tobacco suitable for cigars, it is desirable that it should have a "grainy" leaf.

"It would be very desirable to find a new ground for growing cigar material, because there is a ready market for it, and it is just possible that Ceylon, being in a similar latitude to Sumatra, might happen to have soil that is also suitable, but of this those on the spot must be the judges.

"THOS. GRACEY,
Director, British-American Tobacco Company, Ltd."

FRUIT CULTIVATION.

A consignment of some 700 grafted fruit plants, consisting of varieties of mangoes, oranges, pumelo, lime, lemon, citron, pomegranate, sweet lime, guava, roseapple, grape, fig and loquat has just been received, and will be distributed immediately to applicants who have already booked in advance.

Dr. Muttukumaru writes under date 30th August :—"It may interest you to know that one of the grape vine grafts you sent me in October, 1909, gave this year about twenty bunches of grapes. It is of the purple variety."

A few plants are still available of the Mozambique orange, the fruit of which is described as about 10 oz. in weight, globular, skin of medium thickness,

surface lightly marked by vertical furrows, pulp pale yellow, juice very sweet.

SEED DISTRIBUTION.

The second distribution of vegetable seeds for the year among members of the Society takes place almost immediately. Fifteen hundredweights of *Tephrosia purpurea* seed for growing as green manure, and one ton of soy bean seed (received through the Buitenzorg Gardens) were indented for to meet special applications.

The Hickory King maize seed last distributed has given good results. Agricultural Instructor Chelliah reports that it is worth seven or eight times the value of an equal area of *Setaria Italica* in the North. The teacher of Alawatugoda School has forwarded some fine specimens of cobs, and the Korala of Balangoda has also a satisfactory report to give.

INVESTIGATIONS.

The Director of the Imperial Institute has made the following reports on samples of Mee-seed and oil:—

Remarks.—"The kernels of *Bassia latifolia* and *B. longifolia* are already exported from India as "Mowra kernels," and their commercial value is well known and need not be discussed here. It may, however, be pointed out that in recent years there has been a great increase in the prices of almost all oil seeds, and that consequently the present time is opportune for developing the trade in these seeds, especially those yielding solid or semi-solid fats which, like Bassia fats, are suitable for the manufacture of soap or candles, as well as of edible fats, for which there is an increasing demand.

"At present Bassia kernels are more popular with oil crushers in Germany and France than in the United Kingdom. One reason for this appears to be that the cake left after expressing the fat is considered poisonous to cattle, owing to the saponin it contains, and consequently only fetches low prices, being used as a manure instead of as a feeding stuff. Investigations recently carried out at Liverpool have shown that oil-cake made from the kernels of *Bassia longifolia* contains a saponin-like glucoside, which has a marked physiological action when injected sub-cutaneously, but does not appear to be very active when fed to animals. Careful feeding trials on a considerable scale with oil-cakes made from Bassia kernels would, however, have to be made before it would be safe to say whether or not such materials could be used as feeding stuffs for cattle, and even if they proved harmless, it is probable that their intensely bitter taste would preclude their use in this way.

"*Seed.*—The consignment was in poor condition, the kernels being moist and mostly mouldy. The seed consisted of 30 per cent. shell and 70 per cent. kernel. Yield of oil was about 39 per cent. from the moist kernels which contained about 24 per cent. of moisture. After exposure to the air for about a day the kernels contained only 6 to 7 per cent. of moisture and 47 to 48 per cent. of oil, which is a lower percentage than that found for *Bassia longifolia* kernels from India. Picked kernels in good condition gave 54 per cent. oil. The oil is a soild yellowish fat having the usual appearance and properties of the fat derived from *Bassia longifolia* kernels. The poor condition in which the seeds arrived rendered them unsuitable for technical trials. It should be borne in mind that there is no sale in the United Kingdom for unshelled Bassia seeds, and a consignment of at least 2 cwt. of kernels (shelled seeds) should therefore be forwarded to the Imperial Institute in order that trials may be carried out. The kernels should be carefully dried in the sun before shipment. If delivered in sound condition the kernels would realise about £1 to £2 in advance of the market price of Mowra seed kernels, which were quoted at about £11 per ton in the United Kingdom in May, 1911.

"*Oil.*—The sample of 2½ lbs. sent by the Ratemahatmaya of Uda Dumbara, Urugala, proved on examination to be a clear granular fat of pale greenish yellow colour. Fat of this quality would probably be worth about £32 per ton in the United Kingdom under present conditions, but it is impossible to say whether this price would be realised for all consignments sent from Ceylon, for the reason that native-prepared fats of this description frequently vary very much in quality."

C. DRIEBERG,
Secretary, C.A.S.

Colombo, 16th October, 1911.

COMPARATIVE FACTS AND FIGURES:

THE BOON OF RECIPROCITY—MARKET CONDITIONS, ETC.

ADDRESS OF W. S. MACLEOD.

(From the *Manila Bulletin.*)

Among the addresses delivered at the Merchants' Association annual banquet was one by Mr. William S. Macleod,

manager of Macleod and Company, which contained some interesting figures, among which was a comparative statement of the trade of the islands, which is an advance statement furnished by the Collector of Customs, and which appears in connection with this article.

Mr. Macleod's address was considered among the foremost of the evening, and is here given in part. Mr. Macleod after making a few introductory remarks said :—

When Congress conferred the great boon of reciprocity upon the islands, all of us looked for a prompt response, and we were not disappointed. Congress, naturally, could only give advantages to those articles of export on which a tariff was levied in the United States; and of the four great articles of export from this country, sugar and tobacco were the two so favoured. Within the first year after the passing of the Payne Bill, the increase in the value of the export of these two articles was over four and one-half million dollars. It is probable, indeed certain, that both of these articles will develop within a very few years into greater sources of wealth than they are even now, especially with the improved methods now being put into use with sugar, and with the probable improvement in the culture of tobacco.

In speaking about exports, we are practically confined to the agricultural resources of the islands. As we all know, this country depends upon its soil. Manufactures and minerals may, in time, become considerable items in our sources of wealth, and we all hope and expect that they will, but at the present moment we exporters have to confine our main attention to handling the farm products of the Philippines. Our monopoly, hemp, has for many years held premier place; but a comparatively new article, copra, is beginning to challenge it. It is not yet well known that these islands are now the largest producers of copra in the world. Twenty years ago, copra, as an article of export was unknown, and it was only made here in order to be expressed into coconut oil for local use. At that time it was a usual thing to see large rafts of coconuts being floated down the river to be loaded into small Hongkong steamers at Fort Santiago, and carried by them to China for sale as fruit. What oil was made locally was used for lighting, for lubricating of practically all the small machinery in use, for cooking, and for other household purposes.

The increase in the production and export of copra is one of the romances of trade. In less than twenty years our copra export has advanced from nothing to over 100,000 weight tons, worth over nine million dollars. The Philippines seem to be in a peculiarly favourable geographical situation for the growth of coconuts, and with the extension of means of communication, there is no reason why copra should not double its production within the next ten years. One reason why it should do so is that copra-making is liked by the natives, and it probably gives better return for the land and labour used than any other crop we produce.

Hemp continues to hold its place as the first of our exports, although, as I have said other articles may go ahead of it in time. A great part of the late discussion on the subject has been devoted to what is called the low price obtained for the article. Now, the terms "low" and "high" are only comparative. I am afraid that our hemp producers were spoiled somewhat by the high prices obtained for the small quantity produced during the war times and just after the drought of 1904.

Mr. Macleod then referred to the poor quality of hemp that has been turned out and placed on the market, and referred to the present market open to Philippine copra and turned his attention to sugar. He said: "Sugar, I think, suffers from the same fault. Up to the time that high polarization sugars began to be produced from beet, the islands found little difficulty in finding sale for all the cane sugar produced. The years 1892 and 1893 were the high water mark, with a production of about 250,000 tons each year, of a value of between seven and ten millions gold, and during several years this crop exceeded the hemp crop in value.

Under the Payne Bill stimulus, it cannot be many years before the 300,000 ton average is reached, and if Congress does not make further concession, we may have to compete with other countries, and we can only do so if the quality of what we produce is as good as theirs.

Tobacco was lightly touched upon, and then Mr. Macleod continued as follows: The largest year before the war showed a total export value of about 30,000,000 dollars, but during the poor years between 1893 and 1898, there must have been times when the annual value was under 20,000,000 dollars. In 1902 our total was 24,500,000 dollars. 1902 to 1909 averaged just over 32,000,000, and the yearly variation was small. The fiscal year 1910 showed about 40,000,000, which was eight millions more than 1909. The Payne Bill

accounted for 4,600,000 of this increase, say 2,700,000 in sugar and 1,900,000 in manufactured tobacco; and ordinary increases outside of the Payne Bill protection were shown in copra 2,500,000 and hemp 1,500,000. These figures are all in gold.

Every dollar of increase in export values is a dollar won for the Philippines, and every dollar thus won means a little more prosperity for the islands and for all of us.

The main object of this Association, and the larger and broader Board of Trade that we all hope and dream that this Association and its kindred will be welded into, is to promote, in every way possible the inter-change of products, but I do not think I mistake the aims of the Association if I say that I believe that its intention is to go even further than that. While this Association must fitly attend in the first place to its special subjects, it can and will act in friendly conjunction with all the other bodies, official and non-official, whose object is the prosperity and good of the Philippine Islands.

Mr. Macleod then gave the comparative statement hereto attached as to exports in 1910 and 1911, and closed with remarks as to the work that is before the Association for the future good of the Islands.

Comparative statement of the principal articles exported from the Philippine Islands during the Fiscal years 1910 and 1911.

		1910. Quantities.	1910. Values.	1911. Quantities.	1911. Values.
Hemp ...	Kilos	170,788,629 ...	$17,404,922 ...	165,649,626 ...	$16,141,342
Sugar ...	,,	127,717,042 ...	7,040,690 ...	149,376,454 ...	8,014,360
Cigars ...	Thousands	196,912 ...	2,973,630 ...	132,217 ...	1,700,712
Cigarettes ...	,,	30,886 ...	34,045 ...	33,662 ...	36,132
Leaf Tobacco	,,	9,739,015 ...	1,598,557 ...	12,161,949 ...	1,794,480
Other Tobacco	,,	181,039 ...	31,263 ...	325,203 ...	74,243
Copra	,,	115,284,851 ...	9,153,951 ...	115,601,270 ...	9,899,417
Hats ...	Number	621,475 ...	290,349 ...	1,025,596 ...	307,987
Coconuts	,,	...	...	632,503 ...	13,594
			$38,527,407		$37,982,267
All other articles	..		1,359,445		2,080,486
			$39,886,852		$40,062,753

INVITES CHINA COAST BUSINESS MEN TO LECTURES.

Series of Lectures under Auspices of Merchants' Association to be given by Bureau of Science.

(From the *Manila Bulletin.*)

Invitations have been sent the Chambers of Commerce of the China Coast asking that their members attend the series of lectures to be given by Dr. Paul C. Freer, Director of the Bureau of Science, and his staff, under the auspices of the Manila Merchants' Association.

President Milton E. Springer and Dr. Freer have arranged the schedule for the first half of these lectures to accommodate not only the steamers from the China Coast, but the Pacific Mail and Great Northern liners as well, so that tourists will be able to gain accurate information regarding the resources of the Philippines in authoritative and attractive form.

It is proposed in these lectures to tak, up the great resources of the Philippines, not only those already being developed, but the great potential resources as well, so that not only the stranger but the dweller in Manila will receive a resumé of the accurate information that the Bureau of Science has been gathering for years. These lectures, experts say, will be of great practical importance, in that they will set forth the commercial side of every topic and give the business-man a closer and, at that, a more comprehensive view of the materials of commerce in the Archipelago.

Not only have special invitations been extended to the China Coast businessmen, but the four Chambers of Commerce of Manila have given most cordial invitations to attend all of these lectures, as it is the desire of the Manila Merchants' Association that businessmen—Filipino, Chinese and European—share in the benefits to be derived.

The Empire theatre has been made available for these lectures through the generosity of the manager, Mr. Bert

Yearsley, and it is expected that every seat will be taken at 5 p.m. on September 19, when Dr. Freer will open the course with a talk on the work of the Bureau of Science, and what it means to the businessmen. The lectures will be illustrated copiously with lantern slides thrown upon the cinematograph screen of the theatre. The following schedule has been arranged :—

September 19, 1911.—1. The Bureau of Science, its meaning to the Commercial Public, and its work, by Paul C. Freer, Director of the Bureau.

October 17, 1911.—2. The Philippine Alcohol Industries, by A. D. Gibbs, chief of the Division of Organic Chemistry.

December 5, 1911.—3. Sugar production in the Philippine Islands by Waller B. Gonder, Iloilo Sugar Laboratory of the Bureau of Science.

January 15, 1912.—4. Road and road materials, by Warren D. Smith, chief of the Division of Mines.

February 23, 1912.—5. The salt production of the Philippines, by Alvin J. Cox, chief of the Division of General Inorganic and Physical Chemistry.

March, 1912.—6. Gold Milling and Mills, by Frank T. Eddingfield, Division of Mines.

April, 1912.—7. The Coconut Production of the Phillppine Islands, by Paul C. Freer, Director of the Bureau.

May, 1912.—8. Silk Production in the Philippines by Charles S. Banks, Entomologist, Bureau of Science.

June, 1912.—9. Economic Plants and Plant Diseases, by Elmer D. Merrill, Botanist, Bureau of Science.

July, 1912.—10. The Sampling of Mines and Assaying, by Paul H. Fanning, Division of Mines.

The lectures begin at 5 p. m. The individual lectures are subject to change.

REPORT ON THE DANISH SYSTEM OF TAXATION.

BY MR. VICE-CONSULAR FUNCH.

(From the *Diplomatic and Consular Reports*, April, 1907.)

A revised system of taxation, embodied in four separate laws, was introduced in Denmark in 1903. These laws are :—

(1) Law amending and supplementing the existing rules of local taxation and State support to the local bodies.

(2) Law relating to the commutation to tithes.

(3) Law relating to the real property tax.

(4) Law relating to the income and property tax for State purposes.

The main object of these laws was to relieve the agricultural class of what was thought to be excessive taxation, as compared with taxation borne by other classes of the community. In order to understand the position, a brief account of the taxation prior to 1903 must be given. Mr. MacDonell's report of July 11, 1890, and the official statistics relative to the proceeds of the taxes may also be consulted.

Local Taxation prior to 1903.—The system of local taxation in the rural districts was revised in 1876, and at that time all the different old rates —poor rate, school rate, &c.—were abolished, or rather amalgamated in one rate, which was levied, partly on income and partly on land. To meet the expenditure for its own Budget the County Council might levy taxes on land; but it had also the right to charge the Parish Council with part of the expenses —*i.e.*, it might levy less tax on land and charge more to the parishes, or *vice versâ*. The proportion in which each Council was to obtain its revenue from land and from the parishes was fixed for a period of three years. The tax-payer paid local land tax both to the County and Parish Councils, but local income tax only to the parish.

The land tax, both for the parish and the County Council, was based on a valuation of the productive power of the ground made during the first forty years of the nineteenth century. It will easily be understood that, being based on this old valuation, the local taxes, which had increased very considerably during the last century became very unequal. At the time of the valuation the tax was fairly just, but in the course of the century the economic condition of the farmers changed very much owing to railways, improvements, &c., so that the tax paid by agriculturists was no longer proportionate to their ability. On the other hand, the number of non-farming inhabitants of country districts increased with the development of modern industries, and this class paid too little tax in proportion to their ability, since they only paid according to the productive power of the small plots of land occupied by residences or shops.

The local income tax, called the Property and Ability Tax, which was levied in the parishes, was assessed according to "the whole financial position" of the person concerned, and, there being no more definite regulation of assessment than this, different principles were, as a matter of fact, applied in different parishes. The tax,

however, involved less injustice than would appear at first sight, as all people in the parish knew each other, and were acquainted with each other's financial position.

The growth of the local expenses and the taxes is shown by the figures for 1892 and 1902, the year before the reform of taxation. (The financial year for the parish is January 1 to December 31; for the country, April 1 to March 31.)

Year.	Expenses.		Land Tax.		Income Tax.	
	Value in 1,000,000 Kr.	Value in 1,000*l.*	Value in 1,000,000 Kr.	Value in 1,000*l.*	Value in 1,000,000 Kr.	Value in 1,000*l.*
1892 ...	23 to 24	1,280 to 1,330	4·12	690	4·3	240
1902 ...	30 31	1,670 1,720	13·4	740	6·6	370

The increase of the local expenditure had for many years given rise to discussion, both outside and inside Parliament, and the suggestion which met with approval generally was that the best manner of relieving the local tax-payers was to transfer the greater part of the existing State land taxes and State building tax to the local bodies. In the end, however, these State taxes were entirely abolished.

State Taxation prior to 1903.—A review of the former direct State taxation of Denmark will enable us better to understand the motives for this radical change. The entries of receipts in the State accounts for the financial year 1902-03 show under the heading "Direct" the following figures:—

	Value in 1,000,000 Kr.	Value in 1,000*l.*
Old land tax ...	5	270
New ,, ...	1·7	90
"Assessed tax" ...	0·2	10
Building tax in—		
Rural districts	1·1	60
Copenhagen ...	1·6	90
Other towns ...	1·4	80
"Title tax" ...	0·1	5
Total ...	11·1	605

Ten years earlier the total was 9,800,000 kr. (540,000*l.*), the yield of the building tax being 2,800,000 kr. (150,000*l.*). instead of 4,100,000 kr. (230,000*l.*). The proceeds from the other taxes were about the same.

The "Assessed tax" was not paid by the inhabitants, but by the muncipalities; it was abolished by the reform in 1903. The "Title tax" is paid by persons upon whom a certain rank had been conferred.

The three remaining taxes are:—

(1) The old land tax ("Gammelskatten"), based on the productive power of the land, such as had been fixed by a valuation in 1688. As pointed out in Mr. MacDonell's report, the "Gammelskat" was not in reality a tax, but a fixed ground rent similar to the old English land tax.

(2) The new land tax ("Land-og Ligningsskatten"), also based on the productive power of the ground, but in accordance with the same valuation (from the beginning of the nineteenth century) as that on which the local land tax was assessed.

(3) The building tax on buildings in and outside the cities which were not used for agricultural purposes.

Of the 10,800,000 kr. (600,000*l.*) to which the three taxes amounted, the rural districts paid about 7,500,000 kr. (420,000*l.*).

Tithes.—Besides these sums, the tithes in their different forms yielded 6,000,000 to 7,000,000 kr. (330,000*l.* to 390,000*l.*) annually. The tithes originated about the year 1000, and have now become entirely obsolete. It would take too long to discuss them in detail; it is sufficient to mention that (*a*) the tithes are now all commuted into fixed yearly rents; (*b*) the townspeople and about a fourth of the farming class do not pay tithes; and (*c*) the burden of this "tax" falls very unequally on the tax-paying farmers. On the other hand the tithes, in their present shape, cannot be regarded as public taxes, as many of them are private property, and from the fact of their unequal assessment are in reality ground rents. Nevertheless, great dissatisfaction has always prevailed amongst the peasants owing to "peasant land" only having to pay tithes, although the buying and selling of the land has undoubtedly tended to do away with the supposed injustice.

(To be continued.)

Review.

CACAO.

A Manual on the Cultivation and Curing of Cacao by J. H. Hart, late Superintendent of the Royal Botanic Gardens, Trinidad. London, Duckworth, 1911, 307 pp.

The name of Hart will always be closely associated with Cacao cultivation in the West Indies. By a sad stroke of fate the author of this book did not survive to see its publication. Mr. Hart. after retiring from Government service in 1908, died in Trinidad on February 18th, 1911, at the age of sixty-four, and his loss will be deeply felt wherever agriculture is pursued in the tropics.

The work now before us makes a great advance both in style and contents over the paper covered volume published in 1892, of which we believe it represents the third edition, and we have no hesitation in recording our opinion that the book is likely to become, and to remain for many years, the standard work upon the subject of Cacao. The book deals successively and at length with the botany and nomenclature of cacao, with the operations of planting and cultivation, and with the nature and treatment of diseases both of animal and of vegetable origin. The processes of harvesting, fermenting and drying are dealt with in considerable detail, whilst later chapters discuss questions of yield and price, food value and manufacture—in fact no branch of the subjects is any way neglected.

The methods of curing in vogue in Trinidad differ considerably from those employed in Ceylon, the process of claying, for example, being one which is not very likely to find favour in this country, But the best methods of estate treatment and cultivation are probably much the same all the world over, and in this connection we would specially commend to Ceylon readers the twelve pages which deal with "manuring," and which contain in our opinion an admirable epitome of this difficult subject. Mr. Hart's views on manuring are the result of long continued experience of practical work upon actual cacao estates, his conclusions are remarkably confirmed by the result of scientific experiments carried out during the past nine years at Peradeniya.

"Let us premise," writes Hart, "that a tree in good health needs no manure. Such a tree is doing its work well, and to the fullest extent, and therefore to feed it with manure would be like overfeeding a horse, and it would just as quickly get out of condition." And again, "The application of strong manures to trees in good health and in average bearing would tend to encourage rank and sappy growth which would be non-productive and loss of crop would result." Manures may, however, be employed with advantage to bring backward trees into bearing, or to enable a tree which has set a heavy crop to bring that crop to maturity.

The practise of deep forking, and even that of digging manures into the ground is unhesitatingly condemned. "To dig deeply about the roots of a surface feeding plant for the purpose of applying manure would be absolutely absurd, as we should thereby destroy the very organs or mouths, which are needed to take up the plant food presented to them, and are situated in the proper place to carry out the process to the best advantage." "The writer has seen the practise carried out with dire effect more than once in Trinidad, and it is quite certain that, although it may be carried out with considerable safety in a temperate climate, when trees are at rest, it is fraught with the greatest danger in the tropics."

"The destruction of roots which the operation of burying manure occasions, would, in most cases, completely nullify the action of the manure applied, as the broken roots would not have the power, or the same amount of surface for absorbing food, as when uninjured." And again, "The cacao tree, although it likes a deep rich soil, is also a surface-feeding plant, and the ground around the trees cannot be forked or dug with impunity, for, although the tree will stand considerable hardship, it is nevertheless materially injured when the roots are mutilated."

The best kind of manure for cacao, according to Hart is dung, and it should be applied superficially in the form of a mulch. Any kind of a mulch is beneficial, and it would appear as if the surface feeding roots are specially sensitive and require special protection, so that any removal of the natural surface mulch of leaves which covers the ground of all good cacao estates would be highly injurious.

It is clearly impossible for us in the short space at our disposal to deal with all the chapters of this interesting book at the length which we have accorded to the chapter on manuring. As regards diseases, Hart enumerates eighteen varieties of fungal disease, but he is not quite up to date, as no mention is made

of Rorer's work, actually carried out in Trinidad, which establishes the identify of stem and a pod canker, and attributes both to the agency of Phytophthora, a result recently confirmed by Petch in Ceylon.

As regards the varieties of cacao, Hart's classification differs little from that of Sir Daniel Morris which was adopted by the reviewer in a circular published in 1904. The Old Red variety of Ceylon appears to agree most nearly with the Venezuela Criollo of Hart's classification, whilst the types figured of Trinidad Forastero Veraguso and Forastero Amelonado can be closely matched by two of the most prominent varieties of cacao growing on the Experiment Station, Peradeniya. Our experience does not support Hart's view as to the constant inter-crossing of cacao varieties. There are now growing on the Experiment Station two acres, one of Green Nicaraguan Criollo and one of a red form of the same variety. Practically all the trees on both plots have preserved the precise colours of the parental pods, although the trees from which the seeds were taken grew in a mingled group, red and green alternately.

We have omitted to refer to an important matter in connection with cultivation upon which the author's views have changed since the early days of his experience with cacao. Formerly Hart was opposed to the use of any kind of shade, but more recently he has come to the conclusion that the correct amount of shade is a matter of the greatest importance. This is certainly the case in Ceylon where proper attention to the growth of shade trees is one of the leading factors of success in cacao cultivation. In Trinidad two species of Erythrina are used for this purpose—relations of the dadap which plays such an important part on Ceylon Cacao estates.

For further points of interest we must refer the reader to the book itself, which is one that should find a place on the shelves of every up-to-date cacao planter. R. H. LOCK.

Correspondence.

"COW" TREE OF CEYLON AND PAPAYA.

Gdefogguritb S. R. T.,
Valavnur, 10th September, 1911.

Sir,—I request that you will be good enough to let me know in detail about the milk-yielding tree *Gymnema Lactiferum*, which is reported to yield milk like a cow, and to be cultivated in Ceylon. I wish to cultivate the same, and so I earnestly request of you to give me full information on the subject at your earliest convenience, and oblige.

I further request that you will be good enough to let me know also about the cultivation of papaw or Papaya. Its juice when manufactured finds a ready market, and it is used for digestion.

A friend of mine told me that I can get the information from you, and so have to trouble you.—Yours sincerely,

N. R. RANGACHARI.

[We are afraid our correspondent has been misled. Here is what Trimen says about the *Gymnema*:—

G. Lactiferum, Kurunnan S. and T. This is the Cow Plant of Ceylon, of which so many fables have been written (Tennent, Ceylon 1, 101, foot note) based on the erroneous description of Hermann that its milky latex is a substitute of the milk of the cow. The leaves are believed to increase the secretion of milk (in animals).

As regards papaw, we quote from the U. S. Consular reports for June:—

"Papaw juice is extracted from the fruit of the papaw tree, which grows rapidly, attaining its full bearing capacity in a year. It produces from forty to fifty papaws of a dark green colour, ripening to deep yellow, in shape resembling a squash. A very light superficial incision is made in the fruit, from which exudes a clear water-like juice, which on exposure to the air becomes opaque. As it drips from the fruit it is received in a porcelain-line receptacle. As it is very corrosive, metal receptacles would injure its appearance and qualities. It possesses great digestive virtues, and the refined article is considered superior to all animal pepsins.

After the desired quantity has been collected, the juice is placed in shallow porcelain or glass-lined pans and allowed to evaporate. While this is not a very delicate or difficult operation, it requires considerable attention, so that the juice will dry uniformly and the product be white and well granulated. In its granulated state it is shipped to the United States, undergoes a refining process, and is sold as the papaw of commerce for medicinal purposes.

The ripe papaw is palatable and an excellent aid to digestion. Meat wrapped in papaw leaves for a short time becomes quite tender without any impairment in appearance or taste.

In extracting the juice the hands should be protected by rubber gloves, as in its crude state it attacks the tissues.

An average tree will produce about ¼ lb. of the granulated juice. It sells in the United States for from 4 to 6 dollars per lb. in the crude state."]

MARKET RATES FOR TROPICAL PRODUCTS.

(From Lewis & Peat's Monthly Prices Current, London, 19th July, 1911.)

	QUALITY.	QUOTATIONS.
ALOES, Socotrine cwt.	Fair to fine ...	70s a 75s
Zanzibar & Hepatic ,,	Common to good ..	40s a 7?s 6d
ARROWROOT (Natal) lb.	Fair to fine ..	8d a 9d
BEES' WAX, cwt.		
Zanzibar Yellow ,,	Slightly drossy to fair ..	£6 15s a £6 17s 6d
Bombay bleached ,,	Fair to good	£7 10s a £7 15s
,, unbleached ,,	Dark to good genuine ..	£5 15s a £6 7s 6d
Madagascar ,,	Dark to good palish	£6 10s a £7
CAMPHOR, Japan ,,	Refined	1s 5¾d a 1s 8d
China ,,	Fair average quality ...	155s
CARDAMOMS, Tuticorin	Good to fine bold	2s 4d a 2s 8d
	Middling lean	1s 10d a 2s 1d
Malabar, Tellicherry	Good to fine bold ..	2s 2d a 2s 8d
Calicut	Brownish ..	1s 8d a 2s 2d
Mangalore ,,	Med brown to fair bold	2s 3d a 3s 2d
Ceylon, Mysore ,,	Small fair to fine plump	1s 8d a 3.
Malabar ..	Fair to good ..	1s 8d a 1s 10d
Seeds, E. I. & Ceylon ,,	Fair to good .	1s 11d a 2s
Ceylon Long Wild ,,	Shelly to good ..	6d a 1s 6d
CASTOR OIL, Calcutta ,,	Good 2nds .	3½d a 3⅝d
CHILLIES, Zanzibar cwt.	Dull to fine bright ...	40s a 45s
CINCHONA BARK.—lb.	Crown, Renewed	3⅜d a 7d
Ceylon	Org. Stem	2d a 6d
	Red Org. Stem	1¾d a 4¼d
	Renewed	3d a 5¼d
	Root	1⅜d a 4d
CINNAMON, Ceylon 1sts	Good to fine quill	6½d a 1s 5d
per lb. 2nds	,, ,,	5¾d a 1s 4d
3rds	,, ,,	5d a 1s
4ths	,, ,,	4½d a 8½d
Chips, &c..	Fair to fine bold	2¼d a 3d
CLOVES, Penang lb.	Dull to fine bright pkd.	11d a 1s 2d
Amboyna ..	Dull to fine	9d a 10d
Ceylon ..	,, ,,	9d a 10d
Zanzibar	Fair and fine bright	8d a 8¼d
Stems ..	Fair	3d
COFFEE		
Ceylon Plantation cwt.	Medium to bold	70s a 113s
Native	Good ordinary	
Liberian ,,	Fair to bold	62s a 68s
COCOA, Ceylon Plant. ,,	Special Marks	75s a 85s 6d
	Red to good	65s a 73s
Native Estate ,,	Ordinary to red	43s a 64s
Java and Celebes ,,	Small to good red	25s a 77s
COLOMBO ROOT ,,	Middling to good	1?s 6d a 15s
CROTON SEEDS, sift. cwt.	Dull to fair	47s 6d a 55s
CUBEBS ,, ,,	Ord. stalky to good	190s a 200s
GINGER, Bengal, rough,,	Fair	35s nom.
Calicut, Cut A ,,	Small to fine bold	80s a 85s
B & C ,,	Small and medium	60s a 70s
Cochin Rough ,,	Common to fine bold	40s a 42s 6d
	Small and D's	40s
Japan ,,	Unsplit	36s
GUM AMMONIACUM ,,	Ord. blocky to fair clean	40s a 67s 6d
ANIMI, Zanzibar	Pale and amber, str. srts	£15 a £16
	,, ,, little red	£12 a £14
	Bean and Pea size ditto	75s a £12 10s
	Fair to good red sorts	£7 a £10
	Med. & bold glassy sorts	£5 a £7
Madagascar ,,	Fair to good palish ...	£4 a £8 15s
	,, ,, red ...	£4 a £7 10s
ARABIC E. I. & Aden ,,	Ordinary to good pale	25s a 32s 6d nom.
Turkey sorts ,,		47s 6d a 60s
Ghatti ,,	Sorts to fine pale ...	20s a 42s 6d nom
Kurrachee ,,	Reddish to good pale ...	20s a 30s ,,
Madras ,,	Dark to fine pale ...	15s a 25s ,,
ASSAFŒTIDA ,,	Clean fr. to gd. almonds	£18 10d a £21 5d
	com. stony to good block	25s a £15s
KINO	Fair to fine bright	9d a 1s
MYRRH, Aden sorts cwt	Middling to good	55s a 60s
Somali ,,	,, ,,	50s a 52s 6d
OLIBANUM, drop ,,	Good to fine white	45s a 50s
	Middling to fair	35s a 40s
pickings ,,	Low to good pale	12s 6d a 27s 6d
siftings ,,	Slightly foul to fine	20s a 22s 6d
INDIA RUBBER lb.	Fine Para bis. & sheets	5s 5d
	,, Ceara ,, ,,	5s
Ceylon, Straits,	Crepe ordinary to fine..	5s 3d a 5s 7d
Malay Straits, etc.	Fine Block ..	5s 7d
	Scrap fair to fine ..	4s 4d a 4s 8d
Assam	Plantation ..	4s 2d
	Fair II to ord. red No. 1	3s a 3d 6d
Rangoon	,, ,,	2s 6d a 3d

	QUALITY.	QUOTATIONS
INDIARUBBER. *(Contd.)*		
Borneo	Common to good	1s 9d a 2s 8d
Java	Good to fine red ..	2s 10d
Penang	Low white to prime red	1s 8d a 2s 6d
Mozambique	Fair to fine red ball ...	3s 6d a 4s 2d
	Sausage, fair to good ..	3s 6d a 4s 1d
Nyassaland	Fair to fine ball ...	3s 4d a 3s 11d
Madagascar	Fr to fine pinky & white	3s a 3s 4d
	Majunga & blk coated ..	2s 1d a 2s 6d
	Niggers, low to good ..	8d a 2s 10d
New Guinea	Ordinary to fine ball ..	2s 6d a 3s 6d
INDIGO, E.I. Bengal	Shipping mid to gd violet	3s 2d a 3s 8d
	Consuming mid. to gd.	2s 8d a 3s 1d
	Ordinary to middling	2s 5d a 2s 8d
	Oudes Middling to fine	2s 6d a 2/8 nom.
	Mid. to good Kurpah	2s 2d a 2s 6d
	Low to ordinary	1s 6d a 2s
	Mid. to fine Madras	None here
MACE, Bombay & Penang	Pale reddish to fine	2s 3d a 2s 6d
per lb.	Ordinary to fair	2s a 2s 2d
Java	,, ,, good pale	2s a 2s 4d
Bombay	Wild	4d a 5d
MYRABOLANES, cwt	UG and Coconada	4s 6d a 5s
Bombay ,,	Jubblepore	4s 6d a 6s 3d
	Bhimlies	5s a 6s 6d
	Rhajpore, &c.	4s 6d a 5s 9d
Bengal ,,	Calcutta	4s a 4s 6d
NUTMEGS— lb.	64's to 57's	10d a 1s
Singapore & Penang ,,	80's	6¼d a 7d
	110's	5½d
NUTS, ARECA cwt.	Ordinary to fair fresh	17s 6d a 20s
NUX VOMICA, Cochin	Ordinary to good	8s 6d a 9s 6d
per cwt. Bengal	,, ,,	7s a 7s 6d
Madras	,, ,,	7s a 8s 6d
OIL OF ANISEED ,,	Fair merchantable	4s 10d
CASSIA ,,	According to analysis	3s 3d a 3s 7d
LEMONGRASS ,,	Good flavour & colour	4½d
NUTMEG ,,	Dingy to white	1¼d a 1¾d
CINNAMON ,,	Ordinary to fair sweet	2d a 1s 4d
CITRONELLE ,,	Bright & good flavour	11d
ORCHELLA WEED—cwt		
Ceylon ,,	Fair ...	10s
Madagascar ,,	Fair ...	10s
PEPPER—(Black) lb.		
Alleppy & Tellicherry	Fair ...	5¼d
Ceylon ,, ,,	,, to fine bold heavy ..	5d a 5¼d
Singapore ,, ..	Fair	5d
Acheen & W. C. Penang	Dull to fine	5d a 5¼d
(White) Singapore ,,	Fair to fine	7⅞d a 9d
Siam ,,	Fair	7¾d
Penang ,,	Fair	7d
Muntok ,,	Fair	8½d
RHUBARB, Shenzi ..	Ordinary to good ..	1s 2d a 2s 6d
Canton ..	Ordinary to good ..	10d a 1s
High Dried ..	Fair to fine flat ...	8½d a 9½d
	Dark to fair round ..	5½d a 7½d
SAGO, Pearl, large ...	Fair to fine	18s a 19s
medium ..	,, ,,	17s a 18s 6d
small ...	,, ,,	14s a 15s
SEEDLAC cwt.	Ordinary to gd. soluble	52s 6d a 72s 6d
SENNA, Tinnevelly lb.	Good to fine bold green	4½d a 7d
	Fair greenish	2½d a 4d
	Commonspeckyand small	1¼d a 1½d
SHELLS, M. o'PEARL—		
Egyptian cwt.	Small to bold ...	70s a 127s 6d
Bombay ,,	,, ,, ...	40s a 150s
Mergui ,,	,, ,, ..	£10 5s a £13 5s
Manilla ,,	Fair to good ..	£8 5s a £14 12/6
Banda ,,	Sorts	21s 6d a 29s 6d
TAMARINDS, Calcutta...	Mid. to fine bl'k not stony	10s a 12s
per cwt. Madras	Stony and inferior ..	4s a 5s
TORTOISESHELL—		
Zanzibar, & Bombay lb.	Small to bold ..	8s a 30s
	Pickings ..	8s 6d a 19s
TURMERIC, Bengal cwt.	Fair	20s
Madras ,,	Finger fair to fine bold	25s a 27s
Do. ,,	Bulbs [bright	20s
Cochin ,,	Finger ..	18s
	Bulbs ...	14s
VANILLOES— lb.		
Mauritius .. 1sts	Gd crystallized 3½ a 8½ in	14s a 19s
Madagascar ... 2nds	Foxy & reddish 3½ a ,,	13s a 15s 6d
Seychelles .. 3rds	Lean and inferior ...	12s 6d a 13s 6d
VERMILLION ..	Fine, pure, bright	3s
WAX, Japan, squares	Good white hard ...	40s

THE SUPPLEMENT TO THE

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COMPILED AND EDITED BY A. M. & J. FERGUSON.

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COCONUT PALM CULTIVATION AND PRODUCTION IN THE PHILIPPINE ISLANDS AND IN CEYLON.

The Philippine islands and islets, 3,141 in number, including the Sulu islands, have a total area of 127,853 square miles, against 25,331 for Ceylon, and a population not less than 8,200,000 (the Census of 1903 gave 7,635,426) against 4,105,553 found for this island in the Census of last March. Another comparison is between the Capitals: Manila having a population of 219,941 (in 1903) and Colombo having 211,284 this year. There are, however, about 25,000 "Americans and Europeans" in the Philippines and only 7,625 "Europeans" (foreigners) in Ceylon. Once more, the total Revenue of the Philippines seems to exceed £4,500,000 sterling and that of Ceylon reaching to above 3 millions; while in Trade (Exports and Imports) the Philippines aggregate a value of about £17 millions sterling and Ceylon approximates to (if it does not exceed) 20 millions sterling per annum. So far, by way of an introduction to our notice of the Coconut Palm industry, and information which came before us the other day from the Far Eastern Archipelago.

If the "Philippine Agricultural Review" for July can be trusted—and no doubt the American authorities have, by this time, taken care to provide official statistics, as approximately correct as is possible, in reference to a leading agricultural industry,—we must revise and enlarge our estimate of the cultivation of the Coconut Palm and its products in the Philippine islands. So also must the compilers of the "Statesman's Year-Book" take steps to get the chapter on this tropical Dependency of the United States written up to date by a responsible official or resident in Manila. In their edition for this year, the Philippines' exports of Copra for 1910 are given at a value of 9,153,951 dollars; but the actual quantities, and destinations, of the exports should be got and given; and if 125,140,822 kilogrammes of copra are produced and made in one year (1910?) and *exported* we suppose, that would be over 120,000 tons, worth over £2,000,000 sterling (?—or equivalent of the figures in dollars ?). It will be interesting to compare the latest "Philippine" figures with those we compiled a few years ago for the "Coconut Planters' Manual":—

	*In Philippines**	*In Ceylon †.*
Total No. of Palms or trees	32,838,544 (bearing trees 22,000,000)	60,000,000
Acres cultivated	(not given)	750,000 acres
Nuts gathered...	937,927,927	1,200,000,000
Consumed for food ...	311,609,148	700,000,000
	Export.	
Copra ‡ ...	125,140,822 kilos or 2,458,123 cwt.	766,906 cwt.§
Oil ‡ ...	6,993,513 liters or about 1,748,378 gallons or about 940,000 cwt.	616,377 cwt.¶
Tuba (?) ...	174,483,484	——
Desiccated coconut	——	27,201,074 lb.
Coconut Poonac	——	309,589 cwt.
Nuts (Exported)	——	16,114 088 number ‖

* Taken from "Philippine Agricultural Review" for July 1911.

† An estimate mainly (save in figures of actual exports)—framed some years back.

‡ Not clear if all these figures represent exports only? If so the trade has increased enormously: in 1899 the Philippines exported 35,000 tons copra (122,906 tons given above), 500 tons coconut oil and 8 million nuts.

§ 772,032 in 1909.

¶ 670,121 in 1908.

‖ 21,188,692 in 1908.

It is clear from the above, that if the Philippines' figures for "copra" and "oil" mean *exports*, Ceylon is much out-distanced in respect of these two products. But allowance may be made for our exports of "desiccated" and ordinary nuts—although "poonac" being the refuse of the kernel after oil is expressed, does not count—that is, if the Americans do not manufacture the one ("desiccated") or ship the other (coconuts) from Manila? What "Tuba" can be, we cannot tell—is there any one here able to enlighten us, and if not, perhaps our Manila correspondent (an old Ceylon resident) can help us. It will be remarked that there is, apparently, a greater crop of nuts in proportion to coco-palms (in bearing) in the Philippines than in Ceylon. Far richer (volcanic) soil, we should say, may account for this, and possibly more regular planting during the first twelve years and cultivation of the older trees in that period of American occupation of the islands. In Ceylon, the bulk of the Sinhalese who own coconut gardens or topes, pay little attention to their palms save to gather the nuts which, probably, average 15 to 20 a year per palm in place of double or treble that number which might be got if due cultivation and manuring were attended to. From the estimates of the crops given, 311½ million nuts are said to be used for "food" in the Philippines out of 938 millions gathered, leaving 616½ million nuts for export in copra and oil (?); while in Ceylon 700 millions are counted for "food" and 500 millions equal the export. The rules laid down (from long experience) in Ceylon, indicate 40 full grown coconuts from an average good palm being required to give one gallon of oil, 12½ of which (or say 500 nuts) equal a cwt.; while copra requires 170 to 200 nuts to a cwt.; and 3 nuts are usually reckoned to every "lb." of "desiccated" product. Apply these rules or requirements to the Ceylon Exports in different products in 1910 and we make out that 540 millions of average nuts would be equivalent to the total; but in the case of the Philippines we find (by our Ceylon rules) that 870 (in place of the 640) millions of nuts, would be required to give the copra and oil figured apart from the "Tuba." One explanation to reconcile the difference might be found if the Ceylon nuts are smaller; but we cannot think it is the fact, and we would ask our Manila correspondent to give us his opinion on this point and to send us any fuller local reports or statistics on agricultural production and exports for the Philippine islands.

Since writing the above we find that Tuba is a beverage and a recent Philippine publication contains the following reference to it:—"The production of tuba, or palm wine, in certain cases, may be more remunerative and probably not more injurious to the trees, than the production of copra. It is possible that the maturing of nuts draws upon the vitality of the young tree more severely than would the loss of the sap (tuba) from the flower buds." The production in the Philippines in 1910 was 174,482,484 litres or nearly 39 million gallons.

NOTES FROM THE COCONUT DISTRICT, N.-W. P., CEYLON.

Marawila, Sept. 21st.

The Surveyor-General's Chart shews

ABSENCE OF RAIN

only along a narrow strip of the North-Western littoral. While the whole island has had rain and deluges, we have not had even one slight shower. The croaking of frogs and the activity of white ants betokened rain for a long while, but so far, the signs of rain have not been realised. The supply of water for domestic purposes has been gradually decreasing till we are reaching famine level.

The decrease in the number of

PADDA BOATS

for the transport of produce is unaccountable, unless the boats have gone on the Kelani and Kalu Gangas. I thought the rise in boat-hire might have been due to the low water in the canal. The water in the canal has risen somewhat and so has boat-hire. Whereas Rs.40 to Rs.45 was the standard rate, Rs.100 is now asked as boat-hire to Colombo.

I have had the honour and the great pleasure of a visit from

MR. WALLACE R. WESTLAND,

Manager of the Papua Rubber Plantation Co., Ltd. Though the Company is a Rubber Company, yet coconuts are planted largely. Their cultivation will be extended, while that of rubber will stop.

The growth of the

COCONUT PLANT IN NEW GUINEA

is equal to the best I have seen in the Island, judging by the photographs I was shown. The soil is chiefly volcanic and sandy and is extremely rich, judging not only by the growth of the coconut plants, but also by the undergrowth, which is heavy and very thick. Sisal hemp, too, is grown on the plantation, which is 5,000 acres in extent. The rainfall varies from 40 to 150 inches on different parts of the plantation. The labour is native and is indentured. It costs £2 to bring a cooly to the estate. The pampering he receives when there, Mr. Westland detailed recently in your columns. Owing to the want of labour, almost every agricultural operation is mechanical. The land is not heavily timbered. The trees are felled and the stumps are grubbed with the "Devil stump puller," with which the biggest stumps are pulled out by two coolies. If the trees be hard wood, they are sawn into the required lengths to be sold or used for piles for buildings on the estates. As in the Straits, all the buildings are on piles. But not for the same reason. The land is not low-lying and drained. The inferior timber trees are sawn into lengths and heaped up by mules with chains and hooks and burnt. All branches are cut into lengths and are taken in the Company's boats to town, when going for stores, and are sold there. The proceeds cover the cost of opening the land. The

Company has a fleet of motor and steam hoats and small schooners and quite respectable jetties on the plantation. The agricultural animals are chiefly mules, imported from Australia and are about 14 hands high.

After the trees on the land to he planted are felled and the stumps pulled out, the undergrowth is mowed with an animal power

MOWER

and burnt. Holes are dug by coolies and they are filled with plough and rake drawn by mules. If necessary, the mouths of the holes are trimmed by coolies. Thereafter, all the operations are mechanical and up to-date. The soil is thoroughly cultivated and kept in a proper state of tilth. Writing to me originally, Mr. Westland stated: "It may interest you to know that on one of our experimental estates, the coconuts looked yellow, stunted and showed very poor growth for their age. The entire estate was thoroughly ploughed twice, once up and once across the lines. The result has more than justified the expense. The coconuts now are green, vigorous, and have made astonishingly rapid growth in the short time that has elapsed." I commend this experience to all coconut planters in Ceylon.

For experimental purposes, different kinds of

LEGUMINOUS SHRUBS

are grown on different plantations and turned into the soil. Mark the method of doing so. A wido furrow is made with the plough. A mower follows and cuts down the shrubs adjoining the furrow. A mule rake fills the furrow with these. The plough on its return journey fills up the furrow and covers up the leguminous plants. The process goes on till the whole land is ploughed and the leguminous plants are huried. This is very far in advance of anything we have reached. Necessity is said to be the mother of invention. In Papua, necessity (the want of labour), has taught agriculturists to adapt methods of cultivation, which are well nigh perfect.

The

PLOUGH

used heing the disc, the danger of its being wrecked by coming in contact with roots and stumps is ohviated. The disc jumps over every obstacle. Mr. Westland says that he has tried almost every kind of plough, but for effective work, nothing can come near the disc. I again appeal to engineering firms to import a few "Massy-Harris" disc ploughs and to the Agricultural Society to give demonstrations of their work.

One of the

MEANS OF TRANSPORT

on this Papuan Estate is with sledges, where the sand is heavy. I told Mr. Westland that it was a strange circumstance that this idea occurred to Mr. C R Cumberland. When be was A. G. A. of Chilaw, he asked me whether I did not think that if sledge-like contrivances took the place of cart wheels, draught on the estate I am in charge of, would be oasier. I thought that the revolution of wheels made traction easier than rigid sledges. He was certain his idea was good and intended to experiment with sledges, on the sea shore at Chilaw. Before he could put his idea into operation, he was transferred elsewhere.

In the old coffee days, Mr. Westland, senior, and Mr. W H Wright, the veteran planter of Mirigama, were hoth at Haputale and must have known each other very well. The latter will he interested to know that Mr. Westland junior, met his son early this year. He had just returned from a holiday trip to Australia and was said to have been in excellent health. He is doing very well in Papua.

At the time the

STEAM DIGGER

was introduced to the C. T. Plantation Co.'s Coconut Estates, after examination of its work, I was of opinion that a steam plough would be preferable to it. That is a plough drawn by a steam traction engine. I placed my views before my employers, hut they were not acted upon. Mr Wernham from the Solomon Islands called on me and in conversation said he had a steam plough on Messrs. Lever Bros.' Coconut Estates, which could plough 20-30 acres a day. Mr Westland says he uses a steam plough and one of the Directors of his Company in Australia has a motor plough which draws a string of ploughs with a harrow hehind. The work of ploughing and harrowing is done in one operation.—*Cor.*

RECENT EXPERIMENTS ON TEA IN JAVA.

By A. Gordon Howitt, B. Sc. (Berlin.)

It is now generally admitted that the only practicable method of ascertaining the proper cultivation and manuring of sub-tropical and tropical economic plants is by carefully conducted experiments. At one time it was believed that the analysis (chemical and physical) of a soil was necessary as a preliminary to actual experimental work, hut this rather expensive process is obviously of little value, since in the first place it is difficult to obtain a sample of soil which may he taken as an average of any plantation, and, secondly, the results so obtained—that is, the percentages of the plant foods, nitrogen, phosphoric acid, and potash, determined hy using a 1 per cent solution of citric acid—give no direct clue to the possibilities of that soil, and to the availability of the plant foods therein. Looking over a large number of analyses of typical soils from gravels up to heavy clays, one is struck with the small variations in the percentages of the essential plant foods, and those small variations do not coincide with the great differences which actually exist in the fertility of the different classes of soils. Noteworthy, also, is the fact that even the percentages for the poorest soils show, when calculated per acre, a quantity of plant food which is far more than is required by ordinary crops. For instance, chemists tell us that, if the percentage of potash found by a 1 per cent solution of citric acid is above ·01 per cent. then there is sufficient potash in the soil, and the application of soluble potash manures is unnecessary. In giving this statement they overlook not only the many other factors which make up the fertility of a soil, hut also the "ranging" powers of the roots of the various crops,

e.g., the deep roots of wheat as compared with the shallow roots of barley. Let us examine what ·01 per cent potash really means. The apparent density of average soils is a little over 1, and taking the weight of a cubic foot of water at 62·5 lb., the weight of soil, calculated to a depth of 1 foot, gives roughly, 3,000,000 lb. per acre. Now ·01 of this is equal to 300 lb. per acre, and even this is a considerable amount, or as much as would be contained in fully 5 cwt. of muriate of potash. Yet experiments have proved over and over again that the addition of, say, 1 to 2 cwt. of soluble potash manures to these soils, together with nitrogenous and phosphatic manures, has given not only an increase, but a profitable increase, over the unmanured and incompletely-manured plots. To sum up the matter in characteristic American terseness, much of the natural potash in soils is "just about as soluble as window-glass," and so to secure a vigorous start for the young seedlings there must be present in the soil readily available supplies of all the essential plant foods, including potash. Planters are beginning to recognise this from actual experience, with the result that complete, well-balanced manures, containing nitrogen, phosphate, and potash, are being more and more used every year.

Recent confirmation of this is given in the experiments conducted by Mr. R. von Nordheim, on tea plantations in Java. These experiments were introduced in 1907, and the plots, four in number, were carefully chosen to ensure that they were all on the same level, and that the soil by previous results, was practically uniform. The area in each case was, approximately, one bouw, equal to 1¾ acres, though the main point governing the area of each plot was the number of bushes, which was 6,000. The scheme of manuring of the four plots was as follows:

1. Unmanured (0); 2. 2 kg. crotolaria leaves, as green manuring per bush (nitrogen); 3, green manuring as in 2, with 20 grams 40 per cent superphosphate (nitrogen and phosphate); 4, manuring as in 3, with 30 grams 50 per cent muriate of potash (nitrogen, phosphate, and potash).

The crotolaria leaves, which, on analysis, showed ¾ per cent nitrogen, and from one-fifth to one-tenth per cent of phosphate and potash together, were chopped up, and well mulched into the soil, whilst the artificial manures were distributed evenly around each bush, in a circle about 1½ feet from the stem. The cultivation received by each plot was the same, and the results from December, 1907, to November, 1909, was as follows:

	Unmanured.		Green Manuring only.	
	1st quality	2nd quality	1st quality	2nd quality
	lb.	lb.	lb.	lb
From December, 1907, to Novembr, 1909, Green Leaves ..	1,544	6,148	1,604	6,279
Dry tea for two years' harvest ...	1,789		1,833	
Increase over unmanured	—		44	
Value of increase at 9d per lb,	—		33s.	

	Green Manuring with Phosphate.		Green manuring with Phosphate & Potash.	
	1st quality	2nd quality	1st quality	2nd quality
	lb.	lb.	lb.	lb.
From December, 1907, to November, 1909, Green Leaves	1513	6216	1671	6810
Dry tea for two years' harvest	1797		1972	
Increase over unmanured	8		183	
Value of increase at 9d per lb.	6s		137s 3d	

In order to make sure that such a favourable result to the application of a complete, well-balanced manure was no chance result, another set of experiments on younger tea was commenced in April, 1909, with the only difference that the number of bushes was 3,000, and the area accordingly of each plot was ½ bouw, or seven-eighths of an acre. In this experiment, also, the artificial manures were not distributed in a circle round the bushes, but were distributed over the crotalaria leaves, and mulched into the soil on the upper side of each bush. The manures, which need not be quoted, were just half the quantities used in the former experiment, and the results from April, 1909, to December, 1910, were as follows:—

	Unmanured.		Green manuring only.	
	1st quality	2nd quality	1st quality	2nd quality
	lb.	lb.	lb.	lb.
From April, 1909, to December, 1910, Green Leaves	750	5618	766	6039
Dry tea for 20 month's harvest	1449		1550	
Dry tea for one years' harvest	869		930	
Increase over unmanured	..		61	
Value of increase at. 9d per lb.	..		45s 9d	

	Green manuring with Phosphate.		Green Manuring with Phosphate & Potash,	
	1st quality	2nd quality	1st quality	2nd quality
	lb.	lb.	lb.	lb.
From April, 1909, to December, 1910, Green Leaves	706	5538	789	6536
Dry tea for 20 months' harvest	1424		1663	
Dry tea for one year's harvest	854		998	
Increase over unmanured	Decrease of 15		129	
Value of increase at 9d per lb.	Loss:		96s 9d	

Commenting on these results, Mr. Nordheim states that as these experiments were carefully conducted under the supervision of European planters, one may safely conclude that the two essential plant foods in this plantation are nitrogen and potash, for from both experiments the addition of superphosphate diminished rather than increased the yields. One has abundant proof, however, of the advantage of

the application of artificial manures, in addition to green manuring, and it is shown here, as has been found in English agriculture, where stable manure comes into question, that it is more economical to apply a medium quantity of stable manure, and to supplement this with artificial manures.

It is a common belief that increase in quantity is gained at the expense of quality, and to ascertain whether any truth lay in this statement, Mr. Nordheim sent samples of the tea from each plot to the Tea Expert Bureau, Bandoeng. These samples were only distinguished by numbers, and in this way the tea expert had no idea as to the purpose for which this test was required. Taking as a standard for comparison the best quality Assam tea, the report of the specialist was as follows :—

1. (Fully manured plot.) Best quality, fine aroma, of great strength, and fine, clear infusion.

2. (Without potash.) Inferior quality, not the same strength, placed in Class 2.

3. (Green manuring only.) Still inferior to No. 2.

4. (Unmanured.) Very inferior quality.

From the second experiment, samples were also sent to the tea expert, and the results corroborate the above statement, except that the sample from the "unmanured plot" proved to be of better quality than the "without potash" and "green manuring only" samples,

Here, then, we have convincing proof of the value of potash manures to tea plantations. In this case, the addition of potash manures has given not only a profitable increase, but, at the same time, has produced a first-class quality of leaf, which is bound to command always the top price in the market. Planters are beginning to realise the benefits due to the application of artificial manure, and especially potash manure, but there are still many who adhere to the "rule of thumb" and haphazard methods of cultivation and manuring, and to them we commend the perusal of these results, so as to convince them that it pays, and pays well, to adopt the more modern methods of tropical agriculture.—*H. & C. Mail*, Sept. 1.

THE F. M. S. IN 1910.

THE CHIEF SECRETARY'S SURVEY OF THE YEAR.

Agricultural Figures.

The agricultural acreage, and including padi or horticulture, is placed at 396,259 acres, an increase of 42,870 acres over the previous year. The following return gives the principal acreages planted for the past five years.

	Coconuts.	Rubber.	Coffee.
1906	105,000	99,230	9,708
1907	112,560	126 235	10,833
1908	118,697	168,048	8,431
1909	123,815	196,953	5,885
1910	130,344	245,774	6,468

The following return shows the enormous increase in the rubber industry,

Rubber Statistics, 1909 and 1910.

	1909.	1910.
No. of estates	377	435
Acreage in possession	500,431	579,598
Acreage planted to December 31st	195,953	245,774
Exported, lb.	6,087,815	12,212,526
Value, exports	$14,455,982	$38,466,140
Price of rubber per lb.	5/0½ to 9/8½	4/0 to 11/10½

The system adopted by some estates of growing catch-crops for four to five years with the object of obtaining revenue whilst the rubber is not in the producing stage materially retards the growth of the rubber and is condemned by the Director of Agriculture; as pointed out by him, unless the stumps are afterwards removed at considerable expense, they are reservoirs for root disease. He advocates clean weeding, but when labour is insufficient for this he considers a cover crop may be used: experiments are being made by the department in this direction with the object of ascertaining the most serviceable crop.

Of a total area of 27,750 square miles the area of reserve forests is represented by an area of 1,008 square miles: during the year under report 259 square miles were added to the reserve. Further areas amounting to 167 square miles were proposed as reserved but not finally gazetted; also a large camphor forest in the Rumpin district of over 100 square miles was explored and partly demarcated.

THE PRESENT HIGH PRICE OF COFFEE.

The older generation of planters and merchants look upon coffee in the light of a discarded lover, grown old and wrinkled and sadly changed from the days of her young and joyous youth. They occasionally hear of her, some meet her at rare intervals while a very small minority even yet cling to the old allegiance forgetting the horror of the past in the thought that in the days of her first youth before the dread malady overtook her she was a good and generous friend. Coffee has become of so small account in Ceylon that we need say no more than refer to the year 1875 when 873,654 cwt. of plantation and 114,674 of native coffee were exported from Ceylon—or better still to 1870 which gave a total of 1,013,904 cwt. of both kinds of which 885,728 cwt. of "plantation" kind was gathered from 160,000 acres in full bearing and 25,000 acers of young coffee. Now there are, approximately, but 900 acres (Arabian and Liberian) and the 1909-1910 export of both kinds was only 1,329 cwt. When we read, therefore, of high prices ruling elsewhere for the product we are bound to feel, if not a pang of jealousy, a feeling of keen regret at what might have been. That prices are rising there can be no doubt. The price of the standard quality of coffee in New York, "No. 7 quality Rio," for instance, was 10·09 cents on the 28th June last, and, except during a few weeks in December and January last, it was the highest that had been recorded within the last

decade. A primary cause for this is that the world's visible supply of coffee on the 30th June last, 11,085,000 bags, was considerably lower than it had been since August, 1906. The deliveries of coffee, both in Europe and the United States last season, were somewhat below the average for the last five years, but this cannot be ascribed altogether to a falling-off in consumption, since the stocks in both countries at the end of June last were considerably smaller than they had been at any time during the last five years. But the figures which will probably most interest the older planters are the estimates of the current season's coffee crop in all the coffee producing countries of the world, which have been tabulated with the greatest care by four firms of leading Rotterdam coffee-brokers, *viz*, Messrs. Duuring and Zoon, Dalen and Plemp, Kolff and Witkamp, and Leonard, Jacobson and Zonen. Side by side with these figures we give in the following table the actual yields, in bags of 60 *kilos* each, obtained in each of these different countries in the two previous seasons, *i.e.*, the twelve months ending the 30th June, 1910, and 1911:—

	1911-12. (Estimates.)	1910-11. (Actual.)	1911-12. (Actual.
Rio and Santos	13,500,000	10,548,000	14,944,000
Bahia & Victoria	470,000	350,000	409,000
Mexico, Costa Rica, Guatemala, New Granada, Central America ...	1,650,000	1,750,000	1,523,000
Laguayra, P. Cabello, Maracaibo. ...	1,000,000	950,000	1,070,000
Cuba, Porto Rico, and British West Indies ...	180,000	150,000	230,000
Hayti ...	400,000	350,000	451,000
Java, Government and Private ...	330,000	200,000	127,000
Padang ...	50,000	40,000	59,000
Menado, Macassar, Timor, etc. ...	18,000	20,000	13,000
British East Indies and Manilla ...	175,000	120,000	207,000
Africa, Mocha, etc.	160,000	150,000	142,000
Total ...	17,933,000	14,628,000	19,175,000

If this estimate proves nearly correct, and the deliveries in Europe and the United States remain as last year, *viz.*, 17,663,000 bags, it is evident that the statistical position of coffee at the end of this season will remain very much as it was at its commencement. On the other hand, if the crops turn out as estimated, and the deliveries equal those of two years ago, *viz.*, 18,824,000 bags, the world's visible supply of coffee will be reduced and prices will probably increase. It is noteworthy that in the record year, 1906-07, when over 20,000,000 bags of coffee were shipped from Brazil alone, the total production in the word amounted to 24,020,000 bags and the deliveries in Europo and America to only 17,677,000 bags. The price of No. 7 quality Rio in New York varied during that season between 5·20 and 6·95 cents per lb., or about half what it is at present.

WHITE-ANT-PROOF TIMBER.

THE CYPRESS OF WESTERN AUSTRALIA.

INTERESTING PARTICULARS.

A Perth (W. A.) correspondent writes:—In tropical countries the depredations of the white-ant are as familiar to most people as anything possibly could be. Large sums of money have been allocated in various Eastern dependencies of the Empire to stimulate research work which may result in an exterminator of the dread thermites being formed. So far, however, success has not been recorded. There are palliatives, but at best these are mere stop gaps. A timber able to resist white-ants has long been wanted, and now it appears to have been found in the great north-west of this State. So important is the subject that no excuse is necessary for detailing the virtues of the Cypress pine, for such is the name given to the tree which produces this extraordinary wood. Mr. C. Young has lately reached Perth from the north-west, where he located a belt of Cypress pine. I asked Mr. Young to tell me all about it, and his reply was:—

"The timber growing on my land is what is generally known as Cypress Pine (Calistris Robusta) and grows, in many instances, to a height of 80 feet and upwards, with a diameter of 2 feet. The area is situated 40 miles from the Port of Wyndham, the most northerly port of Western Australia. The western boundary of the area is only some ten miles from a navigable arm (that is up to ten feet of the dead low tide) of the Cambridge Gulf. The grain of the timber is very close and works up to some satinlike polish; one of its several features is that it does not warp, twist or shrink in the process of drying or seasoning. It is not only white-ant proof, but is the most valuable timber known for use in the construction of jetties and wharves where the teredo plays such havoc with other woods. I have long resided in the north-west of the State, and the white-ants there are as plentiful as anywhere in India, Ceylon, or the Straits, and I can emphasize strongly the imperviousness of the Cypress pine to the thermites. Many of the telegraph poles used in the northern territory between Port Darwin and Pine Creek are of Cypress pine, and have been erected thirty-nine years ago and are sound as a bell today. In white-ant infested countries, the Cypress pine is of unique value for railway sleepers. There is, of course, its value in the manufacture of furniture and internal decorative work of houses. It lends itself in both cases to astonishingly beautiful results. There is no fear of the timber being exhausted. On the area referred to alone I estimate the present cutting capacity at 300,000 loads of 600 feet per load. Unlike most forest areas the cutting of the already marketable timber would not mean the extinction of the forest. Millions of young pines in all stages of growth are there to take the place of those cut. The Cypress pine only grows in its natural state in the white-ant infested area. The pine forests are found over an enormous territory of the north of Australia, but at present, owing to inaccessibility,

many of these forests are commercially of little value."

"How," I enquired, "about the forest in the Cambridge Gulf?"

"This is the best located so far as accessibility to the markets of the world is concerned. It is only ten miles from navigable water."

"What would you do to ship it, either cut or in logs, to Ceylon or India?"

"The easiest way would be by means of chartered sailing vessels of light draught. It might be more advantageous to ship the timber in logs, so they could be cut at port of destination according to local requirements. For constructional purposes, in connection with houses, stores, factories, etc., in tropical countries, the timber has, in my opinion, no equal and I understand that at Port Darwin there are many buildings which were erected of this timber many years ago and are still in a solid state."—*S. C. M. Post*, Sept. 12.

THE DISTILLATION OF ORANGE FLOWERS AT GRASSE.

[Oranges grow freely in Ceylon both in the lowcountry and upcountry up to 5,000 feet above sea—can nothing be done in distillation of flowers as in the Riviera?—A. M. & J. F.]

The distillation of orange flowers on the French Riviera, and particularly in the district surrounding Grasse, is a very important industry. Here 3,000 tons of these flowers are produced annually, not including the leaves and oven the young fruit of the orange, which is also utilised for making the essential oil, so valuable in the manufacture of perfumes. The best quality of oil, called *néroli*, is obtained from the flowers of the wild, or bitter orange tree, locally termed *bigaradier*. The flowers of the sweet orange are not so productive, and yield a quality known as *neroli doux*, which is inferior to the other. A still more inferior quality is obtained from the *brouts* (the leaves and newly-formed fruit), this quality is called *petit grain*.

The flowers are gathered during the month of May. For their distillation an ordinary still may be used, but a special apparatus is preferable. These are of smaller size at bottom than those employed for distilling spirits, and somewhat higher; a grating is also provided, so that the flowers and leaves are not in direct contact with the fire. An ordinary-sized still should contain about 40 kilogrammes of flowers (88 lb.), and between 50 and 60 litres (11 and 13 gallons) of water. This should yield from 30 to 40 litres (6 to 8 gallons) of liquid.

The products of distillation pass from the still into a receiver, so arranged that the condensed liquid always remains at the same level in it, the water is drawn off from the bottom by a bent tube, whilst the globules of essential oil that float on the surface are collected at the top of the vessel. The oil, though not very soluble in water, is sufficient to impart its perfume to it, and is sold as *eau de fleur d'oranger*, whilst that obtained from the distillation of the leaves is termed *eau de broute*. A kilogramme of orange flowers yields, on the average, 2 grammes (30·86 grains) of *neroli*, worth from 500 to 1,000 francs per kilo (£9 1s 7d to £18 3s 2d per lb.) The orange-flower water is sold, on the average, at 25 centimes per litre (about 2½d per quart). The leaves yield about 1½ grammes per kilo of *petit grain*, worth about one-tenth the price of the *neroli*. The quantity of flowers furnished by each tree varies considerably, and depends on age, vigour of growth, situation, soil and other circumstances. A well-kept garden near Grasse, with trees, half of which were forty years and the other half twenty-two years old, has produced as much as 2,800 kilogrammes (about 2 tons 15 cwt.) in a single year. The cost of planting a hectare of orange trees is estimated at 4,000 francs, or about £65 per acre.—*Journal of the Royal Society of Arts.*

NUTS.

A correspondent sends us the following communication: "In your issue of 5th instant you mention a coconut tree in Batu with 300 nuts on it. This is without doubt a goodly number for one tree. Will they all come to maturity? I have picked 303 nuts off one tree in Ceylon. But you speak of favoured coast districts and say that coconut palms do not produce enough nuts inland to make coconut planting a profitable industry. Has coconut planting been tried inland in Malaya? I guess not. I have seen native trees, uncultivated, bearing well in parts of this district. In Ceylon it has long been admitted that coconuts do just as well inland as on the coast. The great set-back to inland planting is the costly freight to a shipping port, copra and fibre being bulky rather than weighty. Given a free soil and a fair rainfall coconuts will grow well anywhere in the tropics. The ancient idea of sea-breezes is exploded.—*Malay Mail*, Sept. 13.

RUBBER STATISTICS.

THE WORLD'S PRODUCTION AND CONSUMPTION.

According to the customary statistics prepared by the firm of Hecht for the year ended with June 30th, the total production of rubber throughout the world amounted to 79,305 tons in 1910-11, as compared with 76,553 tons in the twelve months which closed with June 30th, 1910, being an increase of 2,752 tons. On the other hand, the world's consumption is returned at 74,082 tons in 1910-11, as against 76,026 tons in the preceding year, being a reduction of 1,944 tons. The harvest of Para qualities comprised 33,480 tons of the world's total production in 1910-11, as contrasted with 33,996 tons in 1909-10, and the consumption with 33,921 tons and 39,363 tons in the two years respectively.

The arrivals of rubber in Europe amounted to 45,085 tons in 1910-11, as against 44,336 tons in the previous year, or an advance of 749 tons, but the arrivals in the United States experienced a diminution of 2,433 tons. The stocks throughout the world are stated to have reached 12,563 tons on June 30th, 1911, as compared with 6,998

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tons in the preceding year, being an augmentation of 5,565 tons. In the case of Europe alone the stocks are returned at 6,554 tons, or 1,447 tons in excess of 1909-10, and those in the United States also advanced from 228 tons in the latter year to 589 tons on June 30th, 1911. The statistics further show that the price of fine Para, which amounted to 10s. per lb. at the beginning of July, 1910, had fallen to 4s 10d. by the middle of January, and to 3s. 11d. by the end of May recovering to 4s. 1d. at the close of June. Since then the price has been fairly stable, and has experienced an increase to 4s. 7d. —*Financier*, Aug. 19.

PALM OIL IN WEST AFRICA.

[By A. P. Chalkley, B.Sc. (London), &c., in the *Financial News.*]

It is a trite saying that the speculating and investing public must always have some commodity to boom, and a good deal of discussion is now prevalent in financial circles as to the direction which the next move is likely to take. A large amount of interest is being centred by those acquainted with the matter in the products of the West Coast of Africa, and it seems very probable that the forthcoming autumn will witness remarkable developments in this part of the world. The possibilities of the oil palm, which is so widely distributed in Nigeria, the Gold Coast, Sierra Leone, and the Cameroons, have as yet been but faintly grasped by most people; but when the subject is thoroughly understood it is likely that the public will be very anxious to provide capital for schemes to promote the palm oil industry.

The palm tree is indigenous, and no special attention is needed for its cultivation; it reaches maturity after seven or eight years, and thereafter produces its fruit with unvarying regularity for an indefinite period, estimated at well over fifty years, and by some observers at one hundred years. The production of palm oil from the fruit is now practically entirely in the hands of the natives, who employ the most antiquated and wasteful methods, and yet are able to dispose of all the oil they collect on most profitable terms. The fruit grows in bunches—the yield of each tree being from five to ten bunches—and they are stripped of their fruit, which is thrown into pits, and the oil collected by washing off with hot water. The nuts which then remain after the palm are thus abstracted from the covering (or pericarp) are picked out and cracked singly by the women between two stones, yielding the palm kernels, which are shipped in bulk to Europe for the palm kernel oil to be extracted.

These means are obviously not economical, and have only been retained because suitable machinery for the extraction of the oil on the spot has

not long been available; but now that such machinery has been successfully designed and constructed, capable of extracting up to 99 per cent of the available oil, as against 30-40 per cent. by the native methods, it is obvious that developments may be expected in the very near future. The imports of palm oil and palm kernels into Europe are steadily rising, and the prices are very well maintained, showing, if anything, a tendency to rise. Palm oil is one of the chief constituents used in the manufacture of soap, and as showing the importance which the large firms attach to it, Messrs. Lever Brothers have acquired a lease of oil-palm land of very considerable extent in West Africa, where the industry will be developed to meet their own individual requirements. In addition to its employment for soap making, an enormous amount of palm oil is supplied to all the railway companies of the world, who use it almost exclusively for the axle-boxes of carriages.

As indicating the continued progress which is being made in the production of palm oil, it may be mentioned that in 1900 about 50,000 tons were exported from Lagos, while in 1909 this had risen to nearly 100,000 tons. The normal selling price of palm oil may be taken as £30 per ton, which figure is, however, frequently exceeded, and the point immediately to be considered is the price at which the oil can be delivered to England and other European countries by extracting it on the spot with modern machinery. It is a question if the palm oil alone should be extracted and the kernels sent home in bulk, or whether the kernel oil should also be obtained. Probably, since the machinery is available, it is a better proposition to extract both the palm and the kernel oil on the spot, and also manufacture the meal from the refuse, and export all to Europe, the meal being quite a valuable product and worth about £4 per ton. Reckoning on the latter course of procedure being adopted, it is estimated that the oil can be delivered to the buyer in Europe at a cost of £13 to £15 per ton, including absolutely all charges, leaving a net profit of something in the neighbourhood of £15 per ton, this estimate being on the basis of a moderate output per annum, say, 2,000 tons.

It is not difficult to understand that this estimate of cost of production and delivery in Europe is a very conservative one, when it is remembered that an enormous and most profitable trade is now carried on in palm oil and kernels, in spite of the fact that the methods employed are very slow and relatively expensive. The cost of collecting the fruit from the trees is extremely small, owing to the cheapness of labour, and as the performance of the machines can be guaranteed with safety, and the cost of transport to Europe is a known quantity, there is in reality very little in the nature of a speculation in the matter. The only possibility of a diminution in the profits below an exceptionally high figure would be the opening out of too many estates, with a consequent over-production and lowering of the selling prices. Even this, however, is doubtful, and would in any case take many years by which time the investors in the earlier companies would probably have regained their money many times over.

It is generally reckoned by authorities who have had long experience in the palm-oil industry that an acre of average palm-bearing land produces sufficient fruit to give a yield of about 12 cwt. of oil per annum; so that from an estate a square mile in extent nearly 400 tons of palm oil could be produced. In actual estimates it is safer to reckon on a smaller quantity than this; but the figure is sufficient to show that the amount of ground necessary to be acquired is relatively small for a reasonable output of palm oil, and the price at which land in the palm district can now be obtained is comparatively low. There is little doubt that the next six months will see the establishment of several palm oil producing companies, and, provided reasonable care has been exercised by the promoters, the prospects are excellent. The chief point into which the investor should inquire is the question of transport facilities from the factory to the coast, and, so long as there is no difficulty or heavy cost of labour involved in this matter, there is very little to be feared, provided the company is in the hands of sound and business-like people.

RAT DESTRUCTION IN JAVA.

M. D. Kruyff, of the Agricultural Bureau of of the Dutch Indies, Buitenzorg, Java, has published an interesting article on the destruction of rats. All visible rat holes were first stopped with earth to ascertain which were inhabited, for the inhabited holes were found re-opened on the following day. Half-a-spoonful of carbon bisulphide was poured in each of these holes, and after waiting a few seconds to allow the liquid to evaporate the mixture of vapour and air was ignited. The result was a small explosion, which filled the hole with poisonous gases, and killed all the rats almost instantly. A pound of bisulphide is sufficient for more than 200 rats holes; 131 dead rats were found in 43 holes which were opened after the operation.

A FREAK PLANTAIN BUNCH.

A plantain tree grown in the vicinity of Colombo has produced a record bunch of fruit. The tree itself is of the average size but the bunch of fruit is quite nine feet or more in length and resembles in shape the trunk of an elephant. The fruit cluster so thickly that the combs are hardly distinguishable, and the total number of plaintains must be a thousand or more. The length of the fruit at the head of the bunch is about 3½ inches while the diminutive ones at the bottom are barely an inch long. The bunch is not mature yet and the flower is still on; the tree appears to have been cut in too great a hurry—due no doubt to the impatience of the native who is now exhibiting it somewhere in Maradana at the rate of 5 cts. per head. The owner avers the young tree was brought to Ceylon from the Far East but to all appearance it is a freak growth of the ordinary variety "Musa Sapientum."

OUR PALM PRODUCTS FOR THIRD QUARTER, 1911.

The quarter has been a very remarkable one in that a very sharp rise took place under all headings and particularly in copra. The drought has been very severe over the period now under review. It was about the worst ever experienced over our nut zone. The dry cycle, now in its sixth year, is—let us hope—near its end. It is sad to see how our palms have suffered, particularly North of Colombo. The South, Matara to Kalutara and Colombo, has been more fortunate. It has had a refreshing showers now and then, which the North-West coast entirely missed. It is simply wonderful how the coconuts came rolling in at mills, and copra sheds, notwithstanding the terrible drought, with less than half our usual rainfall for the year. But the drought has made itself felt in other fashion. Several mills had to stop work, both fibre and desiccating, for want of water. The former were refusing splendid offers, their mattress fibre being as high as Rs.4·75 to Rs. 5 per cwt. in Colombo. The like of this was, we fancy, never known before in the history of the Product.

Oil.—This has been in good demand during the quarter and prices quite up to the best of last year, reaching Rs.600 per ton f.o.b. Colombo. We sent away to end of quarter or say 2nd inst. only 325,195 cwt., against same date in 1910 no less than 448,301 cwt., the falling-off being caused no doubt by the demand being easier during 1st and 2nd quarters, and besides copra-drying went slow over the same period owing to nuts being dearer.

Copra.—The year, that is to end June, was a bad one for copra-drying, nuts being very high while copra went down to about Rs. 67, at which price the men could not secure a nut-supply at a sufficiently low price. During August copra took a sudden turn upwards when mills were practically deserted by nut-contractors who rushed off to dry copra as fast as they could, while mills were forced to go slow as they could not compete with the copra men ; the price of copra reached Rs. 93·25, or 25 cts. per candy less than the record price it went to last year. People who should know seem to think that copra, before the end of the year, will reach the round *Rs. 100* per candy, and if one can judge by the great scarcity of nuts on the trees just now, it would look as if these prophets, mostly old experienced natives; are likely to be right. At date we have only shipped 472,589 cwt. against 562,214 cwt. last year at same date.

Desiccated Nut.—How very different the figures for this are ! If this is to be anything like last year's 3rd quarter, it looks as if we are to ship a record crop this year of nearly 30,000,000 lb. against some *13,000,000* lb. ten years ago. A cheap sugar year is a good year for this product, as manufacturing is seen to go on with increased vigour. While nuts ranged from Rs. 52 to Rs. 60 per 1,000 during the quarter, the demand was fair and prices for the ordinary assortment ranged from *22* cts. to 25½ cts. per lb. Colombo delivery, fancy grades being about 2 cts. per lb. over the above.

Poonac.—We have to record a great falling off in this, the actual figures being 120,720 cwt. against 211,669 cwt. in 1910. No doubt the greater demand locally for this as cattle food, owing to the great scarcity and to the famine price of paddy straw, has raised the price beyond the limit of home and continental buyers. What with great scarcity of water, and high prices of straw and poonac, the poor cart bulls have had a bad time of it all over the low-country, not only over the quarter under notice, but through the whole year.

Coconuts in Shell.—The export of these has been going on very briskly, the total shipped to date being very little under last year, the figures being 12,118,226 nuts, against 12,265,819 in 1910, the U.K. as usual taking the greater number. There is a terrible falling off in the quality of the kernel reported from all sides, this year, owing to over six consecutive years of half rainfall. In many cases the nuts have hardly any water in them, and it is taking nearly 3½ to make a pound of desiccated, while as many as 1,600 are required to make a candy of copra whereas formerly it was a common thing to get a candy of copra from 1,000 to 1,100 nuts.

Fibre and Yarn.—There is a small increase in yarn over last year at date, as also in fibre, notwithstanding the great scarcity of water at miles for retting. The high price of mattress fibre sent up the price of their raw material, the husk going to R2·50 and R3·0 per 1,000 for a time at some mills. Taking it all round, the coconut enterprise was, we think, in a better position during the past quarter. True, a few of our estate proprietors have lost their heads with the high prices nuts and lands are fetching, while many of our trees lost their heads by the drought ; but it is marvellous to see how they go on cropping in the face of the six continuous dry years.

COCONUT PROSPECTS.

There is a belief (which may be well founded) that in the immediate future we are to witness a promotion "boom" in connection with the coconut palm. During the past year or two the products of this tree have commanded very high and very profitable prices. Copra, for example, has been sold consistently for many months past at levels which are not calculated to leave the producers of the coconuts in a state of abject poverty; indeed, we might assert, without fear of any charge of exaggeration, that the profits attaching to such sales have been the reverse of meagre. It is now a common-place among an investing public having substantial amounts embarked in Middle East rubber propositions to hear at almost every turn the coconut tree described as the Consols of this particular portion of the earth. And in a very large measure this is true. What this tree does not represent to a certain portion of humanity it is difficulty to say; on the other hand, what the cultivation may mean to the British investor involves a consideration of possibilities on an entirely different basis. In the first place, a public, asked to support coconut propositions in the form of joint-stock companies, have got to differentiate, and that very clearly, between such proposals and those which involve the cultivation of rubber. At first sight this assertion may appear unnecessary, but closer consideration of the very best of coconut propositions—in the Middle East, at any rate—will prove the essentiality of our attitude in this matter. Coconuts embody a peculiarly native investment; rubber never did, and, generally speaking, never will. Coconuts, if not exactly indigenous to the Middle East, have been a cultivation, from the purely native standpoint, for centuries past; rubber is a cultivation of yesterday. A tropical agricultural condition within the zone inferred by this statement admits of the growth of the coconut palm; until European enterprise indicated possibilities otherwise, the cultivation of rubber was regarded as next to the absurd. We, the aliens, have shown the commercial potentialities of the latter; we must exercise the utmost care that we do not over-emphasise the possibilities of the former cultivation.

In putting the matter thus bluntly we are in no way deprecating the commercial prospects of the coconut palm grown under plantation conditions. It has been shown in the immediate past that this cultivation can be made profitable from the standpoint of the average investor, but no investor in projects associated with such an agricultural business must look for returns equivalent to those obtained by some of the older rubber plantations in the Middle East. It has been put to us by men well qualified to form and hold opinions in this connection, that 10 to 15 per cent. is the best that the investor may reasonably expect from any Middle East coconut plantation. Accepting this statement as savouring of conservatism, we might allow an ultimate and a steady 20 per cent. to be the return upon a carefully-capitalised investment of this character. The profits, naturally, are not dependent upon the mere sale of the coconuts a well-planted property may be expected to produce at the end of seven or eight years. They are the outcome of the sale of copra made, of course, from the nuts obtained from the trees. Some months ago we pointed out that a good maize year in the United States meant a very considerable difference in the selling price of this commodity. The statement was regarded by some of our readers as cryptic; but it was not in reality so. Until recent years the consuming utiliser of fats depended upon the animal product for his main source of supply of the commodity essential to his purpose; within recent times the comparative scarceness of such supplies necessitated application to other, in this particular case to vegetable, sources. To go no further than the soapmaker, we have in this business a very important source of demand for fats. Failing animal supplies, he turns, as is only natural, to vegetable, and in the main product of the coconut—namely, copra—he finds exactly what he wants. The rising price of copra during the past few years merely reflects the growing demand from this and other utilisers of oils in the course of their business, while the absence of animal fats as sources of initial supply for the manufacture of artificial butters has tended to accentuate the improvement in the selling price of this particular commodity. So far as we can see, there is no reasonable prospect of a substantial improvement in the supplies of purely animal fats in the near future. In point of fact, we should be inclined to say that the reverse is likely to prove the case.

This does not, however, warrant us, or anybody else, presupposing that every coconut proposition which may come before the public, as come they will, is worthy of the investor's consideration. Just as has been amply proved the case in connection with rubber propositions, we are bound to find coconut propositions other than Mid-Eastern appealing to the public for support on figures based upon what may be done in Ceylon and Malaya with this particular cultivation. The best of the Middle East coconut companies have been launched free of all pretence as to absurd possibilities; the best of the non-Middle East that have come under our notice up to the present can make no such claim. There are bound to be Middle East absurdities in this particular connection, just as there were absurdities associated with rubber cultivation. To say that no coconut plantation outside the Middle East can pay, or could be honestly conducted, would be foolish to a degree. To assume, at the same time, that the majority of such propositions want the most careful consideration at the hands of potential investors is not going beyond the regions of cold common-sense. What the public have got to understand and appreciate in the matter of coconut promotions is that at best they are out to obtain an interest in a really remunerative investment and at worst they are likely to be no more badly left than a good many were who insisted upon purchasing shares in what to the same individual was an obviously undesirable Middle East rubber promotion.—*Financier.*

SMOKING OF RUBBER.

DUTCH EXPERT'S OPINIONS ON THE METHODS ADOPTED.

The smoking of rubber quite recently came up for discussion at a congress of rubber planters held at Bandoeng (Java). During the debate it was clear that nobody had much experience about the matter, and it might, therefore, be of interest to hear what Dr. K Goeter writes. The following is taken from the *Sumatra Post*:

As is well-known, says the doctor, Para rubber is obtained in a different way to plantation rubber. Then follows a description of the method adopted in Brazil for the preparation of rubber. The writer proceeds: It is, however, most noticeable, and according to the experiences of Trillat and other investigators, that wood smoke contains another substance (besides creosote) having strong conserving properties, namely, formaldehyde which dissolved in water is the formaline or formol of commerce. It was, therefore, thought probable that this stuff would be found in small quantities in smoked rubber. This was indeed found to be so. With the help of various sensitive reactions, I could undoubtedly show the presence of formaldehyde in smoked rubber sheets, so that by reason of this result it may be taken that the conserving work of smoke on rubber must at least be partly attributed to the presence of formaldehyde in the smoke. In the development of smoke it would be well to bear this in mind, by endeavouring to get a smoke that is as rich as possible in formaldehyde.

Quality of the Smoke.

Now it has been found that organic substances, for instance, sugar, will through incomplete combustion, produce more formaldehyde, when they are placed in contact with a metal, such as iron, will give a smoke with a higher percentage of formaldehyde than when that contact with a metal does not exist. This seems to me important enough to revert to the subject again by and by. First I shall particularly direct attention to the fact that smoke is caused by incomplete combustion, in other words by a limited supply of air. On this point it has appeared to me that, in practice, the air is not sufficiently impeded. The wood must smoulder, therefore it must burn without flame and this is only attained by limiting the admission of air. If there is too much air, less smoke is obtained and more fuel is used up; so that it is less economical from two points of view. It was tried to remedy this by making the fuel wet, but this was a wrong procedure because it brought more vapour (aqueous) into the smoking room. As a result of that the rubber took necessarily a longer time to dry. Besides under these circumstances, more tarry products were developed through which one ran the risk of getting a foul tarry deposit forming on the rubber that would spoil the outward appearance and so the quality of the rubber. Finally, it might be well also for planters to bear in mind that in smoke, a poisonous gas, the well-known carbonic oxide is formed, of which the relative quantity increases under the last-named conditions. From a hygienic point of view the health of the coolies working continually in an atmosphere of smoke should be considered. Yet for a uniform smoking it cannot be avoided that the hanging sheets of rubber have to be regularly turned about. In any case proper ventilation should be seen to by having the windows wide open.

Mr. Ridley's House.

Whether smoking has a direct influence on the physical properties, for instance, on the elasticity of the product, I should not dare at present to decide. As a fact, it can only be said now that smoked rubber keeps better and is not so liable to mould as unsmoked rubber. As a rule a higher price is paid for smoked rubber on this account. As to how smoking should be done, opinions differ. Mr Ridley, Director of the Botanical Gardens in Singapore, gives his experiences on this point in the Agricultural Bulletin of the Straits from which I take the following (here follows a description of Mr Ridley's process, noting in particular that he used a wooden house with an attap roof.) Then the doctor continues:—

The vapour and the tarry substances of the smoke are practically fully absorbed by the woodwook and the attap, so that the rubber is not covered with a foul damp substance. Compared with this, the experiences of others using a stone house with a galvanized iron roof and into which the smoke is led from without, were less favourable. In this case there was a deposit of tarry substances on the floor and every part of the building aud even on the rubber. This trouble does not occur in a wooden house; although the woodwork becomes dark-brown and even black by the precipitations from the smoke, the rubber remains dry under these circumstances and of good colour. No other ventilation than through the crevices is necessary. Only when men have to go into the smoking room care should be taken to throw the windows open. Generally the door is left open but as this is at the lowest end of the building, the draught drives the smoke through the rubber to the higher end of the building. Coconut husks may be used as fuel instead of wood, but coconut husk and also sawdust produce sparks which fly up and deposit themselves on the rubber as bits of wood charcoal. Experiment for improving the smoking process by the addition of creosote had not the desired favourable result. The writer concludes his article with a word of praise for Mr. Ridley's wooden house.

SISAL CULTIVATION IN FIJI.

Captain D Calder's sisal plantation at Vesari is at present looking remarkably well, a good proportion of the plants having arrived at the mature stage at which the leaves are milled. The necessary machinery has been imported, and it will not be long until the mill is in running order. Apparently it will not be long ere a shipment of fibre will be made, thus establishing a new industry in Fiji. The Government is offering a bonus of £500 for the first ten tons grown and exported, and it looks as though Captain Calder will enjoy the distinction of drawing the bonus. —*Fiji Times*, Aug. 31.

PEAT UTILIZATION IN GERMANY.

Efforts are being made in Germany to improve the cultivation of marshes and moorland. The success attained in this direction in the Netherlands has attracted attention in Germany, particularly since Dutch gardeners and truck farmers have predicted that, were the marshes of Prussia cultivated like those of Holland, the German canned fruit and vegetable industry would conquer the markets of the world. The German marsh and moorlands cover an area of above five million acres. The largest districts by far are in Prussia, especially in the provinces of Hanover and Schleswig-Holstein, and also in Pomerania, Brandenburg, Posen, and Ost-Preussen. The best quality of peat from German soil, so called air-dry peat, contains about 45 per cent of carbon according to the American Consul at Stettin, 1·5 per cent of hydrogen, 28·5 per cent of chemically bound water, 25 per cent of hygroscopic water, and small amounts of nitrogen. The annual production of peat in the Empire amounts to about 11 million tons. Regarding the heating qualities of the best peat, it has been established that the average peat is equal to dry beechwood at similar weight and equal to coal of half the weight. There is a vast difference, however, in heating power between the different grades of peat at equal weights. If the ash exceeds 25 per cent the peat is deemed not adapted for fuel purposes. The percentage of ash can vary from one-half of 1 per cent. to 50 per cent. The industrial utilisation of peat for lighting purposes has been attempted for many years in Germany, but as yet there has been no satisfactory solution of the problem of how to produce power-gas from peat more cheaply than from coal. In conjunction therewith the generation of ammonia and of electricity has been attracting much attention in scientific quarters, and at the last annual convention of German scientists and physicians this problem was discussed as a result of new views and investigations presented by Dr. Caro, of Berlin. In collaboration with Professor Frank, of Charlottenburg, Dr. Caro discovered a method for the economic utilisation of peat which he claims avoids former mistakes, and which he described as follows. The generator consists of shaft-like ovens, where the burning of the peat is conducted in a way admitting limited quantities of air. Thus also, a dry peat in pieces can be treated, and produces a gas strongly impregnated with tar fumes, which gas, after purification from tar, will furnish a useful heating and power gas. The inventor found that if the gasification process is properly conducted, peat containing as much as 60 per cent. of water could be used. Peat having a percentage of water above 60 could be dried down to this figure by storage in the open air. This process, Dr. Caro asserts, permits the manufacture of a good heating gas during the entire year, and he claims that it can be used in connection with the generation of electricity. In view of the absence of constant water-power in Germany, he thinks that the invention will cheapen the cost of generating current. Another result of the discovery is the extraction of nitrogen by this process, 85 per cent. of this element contained in the peat being recovered therefrom. This nitrogen can be converted into ammonia by the introduction of steam. The method admits of the production of ammonium sulphate, and thus furnishes agriculture with a valuable fertiliser. The Prussian Minister of Agriculture is now engaged in preparing a comprehensive law giving the Government extensive power to stimulate by direct financial assistance, as well as by the use of all available governmental facilities in the broadest application, all efforts for the cultivation of the German marshes and moors, although 90 per cent. of the Prussian high moorlands are in private hands.—*Royal Society of Arts Journal*, Sept. 8.

[Can anything be done to utilise Peat deposits in Ceylon ?—A. M. & J. F.]

THE MARSEILLES PEANUT-OIL INDUSTRY.

Peanut oil ranks next to olive oil in popular favour, being generally preferred in France to cotton oil. It is highly rated as a salad and a cooking oil, and is used extensively in the manufacture of margarine and by sardine packers. It is frequently mixed with olive and other vegetable oils. The industrial grades obtained from the Indian nuts, and the second pressings of the African varieties, are consumed mainly by the soap-making industry, but a certain proportion is also employed for illuminating and lubricating purposes. The Marseilles mills produced in 1910, 170,000 tons of peanut-oil cake. The cake is used for cattle feeding. About 80,000 tons are exported annually, chiefly to Germany and Scandinavia. Peanuts in the shell are never ground whole in the Marseilles mills. On the contrary, expression of the oil is almost invariably preceded by a careful preparation of the nuts, particularly in the case of edible oil. The peanuts are crushed only after having been cleaned and decorticated, and after every effort has been made to remove enirely the germs and the red skin covering the kernels. All these operations are done by machinery. According to the United States Consul-General at Marseilles, the peanuts undergo a preliminary cleaning in a rotary sieve; they are afterwards brought by a lift to the decorticating machine and passed through grooved rollers so adjusted as to husk the nuts without crushing the kernels. The separation of the husks and kernels is effected by ventilation. The germs, sprouts and red skin still adhering to the kernels after the husking process, are stripped off by friction against the coarse-wired meshes of a rapidly oscillating sieve the operation being completed by a ventilator connected with the apparatus. It is extremely difficult, however, to detach the red cuticle entirely from the kernels, and in the case of new crop nuts it is said to be a practical impossibility. After the kernels have been cleaned, they are ground by a crusher provided with two pairs of rollers. The mass emerging from the rollers falls into a "sasseur;" or sifter, which separates the coarse from the fine meal, the remaining stones and other foreign substances having been eliminated by an aspirator. The

meal is then put into hair bags and subjected to hydraulic pressure, from twelve to fifteen bags separated by metal plates being pressed at the same time. A bag contains about ten kilogrammes (twenty-two pounds) of meal. The first pressing, which furnishes the high-grade oil, is made without heating the meal. This pressing lasts usually about one hour. For the second pressing the bags are generally emptied, the meal reground, and brought to a temperature of 86 deg. to 122 deg. Fahrenheit, according to the quality and condition of the nuts. The same amount of pressure is applied as for the first pressing, and the same press may be used. A smaller yield but a finer grade of oil results from the second pressing when the supplementary grinding of the meal is dispensed with. In some mills a third pressure is applied, but this is an unusual practice. The yield of oil varies with the origin and condition of the nuts. The Senegal peanuts in the shell yield about 33 per cent. of their gross weight, the Gambia peanuts 31½ to 32 per cent. Both of these varieties yield from 21 to 23 per cent. on the first pressing, and 10 to 11 per cent. on the second pressing. The average oil yield of the shelled peanuts is about 39 per cent. for the Indian nuts, and 42 per cent. for the Mozambique. After running from the presses peanut oil does not need refining, but is simply filtered. It is then fit for consumption as salad oil. Bleaching is resorted to only in order to produce the white oil required in the manufacture of margarine.—*Royal Society of Arts Journal*, Sept. 8.

THE PEA-NUT.

The valuable paper in the *Journal* of this date on the 'Pea-nut' industry of Marseilles, is defective for its many Anglo-Indian readers in not stating that the 'Pea-nut' is their 'Earth-nut,' 'Ground-nut,' and 'Manilla' gram ['gram '=*Cicer arietinum*, the 'Chick-pea'], the *Arachis hypogœa* of Linneus, known to the natives of India by the names of *mung-phali* ['*Phaseolus Mungo*-fruit'], *bhui-chana* ['Earth-gram'], *chini-badam* ['Chinese-almond'], and *vilati-mung* ['Foreign-*mung*'] etc., etc.; this leguminous plant, although now cultivated over all India and the East Indies, from Abyssinia to China, being a native of South America; and one of the numerous economic plants of that continent introduced, through the intermediation of the formerly puissant Portuguese into Africa and Asia; one of the greatest services rendered by any nation to humanity at large, but for which they never get any credit in the standard histories of Portugal.

For tastefulness the 'Earth-nut,' or 'Pea-nut,' may be classed with the 'Cashew-nut,' and the 'Pistachio-nut,' the *Pistache de terre* of the French; but all three are most indigestible. The oil, in salads, is a good enough substitute for olive oil; but both olive oil and 'Pea-nut' oil are inferior in delicacy of smell and taste to almond oil; while almond oil itself yields the palm for purity of savour to Sesamum oil, the product of *Sesamum orientale*, or *indicum*, of Linneus—the *tila*, that is 'the oil,' *par excellence*, of India; which from the first dawnings of human history in the valleys of the Tigris and Euphrates, and the Nile [Semitic *sim-sim*, Hebrew *semen*='oil' generally, Arabic *al-jul-jul-an*, our 'Gingelly,' etc.], has been used throughout the East for food, both in the grain and the oil pressed from it, and the oil also for lighting purposes: this latter use of it having given rise to the phrase:—'Open Sesame!'—meaning, simply, as we should say, 'Strike a light,' 'Bring a candle,' 'Open up the darkness.' 'Open Wheat!' 'Open Rye!' 'Open Barley!' were of no avail, and only when Kasim cried 'Open Sesame!' was the treasurer in 'Ali Baba and the Forty Thieves' revealed. I was the first to point this out in the first edition of my official 'Catalogue of the Economic Botanical Products' of the Government Central Museum, afterwards [1857-8] enlarged into the Victoria and Albert Museum, Bombay. Cotton and Sesamum are the two most reliable crops in all India; and the proverb runs throughout Southern India:—'When a failure [of the harvest] is feared, at once sow Sesamum.'

Along the Concans coast of Western India the household illuminant used by the fisher-folk is a fish through which a wick is drawn, and as required, lighted; and it is remarkable that the brazen lamps used in the temples of the Concans and up, over the *ghats*, in the valleys on their Deccan slopes, is formed on the longitudinal section of a fish, head and tail and all, with a cup-like hollow, below its belly to serve as a pedestal, and hold the oil, the wick being drawn out into its head.

September 8th, 1911. GEORGE BIRDWOOD.

—*Royal Society of Arts Journal*, Sept. 15.

WHITE PEPPER.

According to a contemporary, the use of pepper was known to the ancient Greeks and Romans as early as the time of Alexander the Great, being a staple article of commerce in the early trade between Europe and India before the days of cotton, tea, and sugar. Its excessive cost is said to have been one of the inducements which led the early Portuguese navigators to seek a sea route to India.

Pepper is entirely tropical in its requirements and seems to thrive best in a moist, hot climate with an annual rainfall of at least 100 inches and a soil rich in leaf mould. The plant grows some twenty feet in height, but in cultivation is usually restricted to ten or twelve feet. The leaves are glossy, broadly ovate, with five to seven nerves, and grow opposite and alternate to a pendulous spike five to eight inches long, containing twenty to thirty white flowers that ripen into a one-seeded fruit with a fleshy exterior. This fleshy berry, covering a soft stone, is about the size of a pea and is at first green, but in ripening turns red and then yellow. The berry contains a resin, to which it owes its hot, pungent taste, and a volatile oil that gives off an aromatic scent.

The white pepper is the black pepper decorticated by maceration and rubbing. The plant produces fruit in three years, and is probably at its best for the next seven or eight years. A

single palm or tree sometimes supports eight to twelve vines, giving an average annual yield in good seasons of about 1,000 berry spikes to the vines on one palm. These spikes or clusters of berries vary in size, but 1,000 should yield on an average five pounds of dried pepper. An acre is reckoned to bear 2,500 plants, to cost about 20 dollars in outlay, and to yield a product of 400 dollars when in its best condition.

The flowers appear in July and August, and the berries about seven months later. The berries may or may not be sorted as they are plucked. If they are sorted, those fully ripe are separated. These are soaked in water for seven or eight days, or heaped so that the pulp ferments, and are then rubbed by hand or on a coarse cloth, if the quantity is small, or trampled under foot if the quantity is large. The pulp is thus rubbed off the inner stone. This stone furnishes the white pepper of commerce. The pulp is completely removed by washing in baskets in running water. The pepper is then dried by exposure to the sun for about a week. This has also a bleaching effect, and the pepper becomes pale grey or pale drab in colour. It can be bleached whiter by a chemical agency.—*Grocers' Journal*, Sept. 23.

HENEQUEN AND BANANA CULTIVATION IN MEXICO.

The State of Colima is peculiarly adapted for the henequen plant (*agava rigida elongata*), which produces the sisal hemp of commerce. The foothills are generally barren of timber, and are often covered with grass, the soil being thin and sometimes rocky, but the climate and all the conditions are perfect for the cultivation of this plant. There is little labour in growing henequen, or in harvesting the crop, and the machinery necessary for the separation of the fibre from the leaves is cheap, and can be worked by the natives. It has been customary in Mexico to cultivate henequen without regard to the number of plants to an acre or to their position. The United States Consul at Manzanillo says that sometimes as many as fifteen hundred are put on an acre of land. The plan usually adopted is to plough and prepare about ten acres of level land, to be used as a nursery, in which the small plants are set six inches apart in rows two feet apart. In this manner, while the larger field is being prepared the young plants acquire a vigorous growth. As the fields are planted, the stock from the nursery is replaced until the first ones set out produce suckers, which may be taken up and left in the sun for two or three weeks, as this makes them better and stronger. Plants in the field are set six feet apart in rows nine feet apart. During the first two years, if the ground is not too rocky, it is planted with maize or beans. After this the henequen requires air and sunshine, and needs no care or cultivation. When the plant commences to mature (fourth year), the leaves can be cut at any time during the dry season, and every twelve months thereafter. During the first four or five years the plant will produce from fifty to sixty 'suckers,' which may be used for transplanting. The net profit from the production and sale of sisal fibre is said to be from £20 to £33 per acre. As the henequen plant lives and produces for fifteen or twenty years, without being transplanted, and is not attacked by insects or disease, and requires little expense for harvesting, it possesses a great advantage over crops which have to be planted each year. In many districts of the State of Colima irrigation is not necessary, and banana bulbs may be set out at any time of the year. The native banana (manzana) will not bear transportation for any distance, and for this reason the Governor of Colima appointed a comission to inspect the 'Roatan' variety, which is grown in the State of Tabasco. The commission returned with 25,060 bulbs, which were distributed amongst the farmers. The 'Roatan' banana is of good size, has a thick skin, fine texture, and is free from fibre and lumps, and has found favour in the American markets. The soil in which the banana is planted should be a sandy loam, and when ploughed and harrowed the ground is measured in squares of three metres (metre=39·3 inches), which gives about four hundred plants to the acre. When the sprouts reach the height of one foot they may be transplanted. When the land is marked into squares, a hole three feet square and three feet deep is made, the plant being placed in the centre. The reason the bulb is planted at this depth is because of the accumulation of leaves and *debris* which form a fertiliser, and also retain the moisture. The land being set with bananas, may be planted with maize or beans, thus reducing the cost of cultivation the first year. It requires twelve months for a stock to mature and produce a bunch of fruit from the bulb. During the growth of the first stock there will come several shoots, the largest one being allowed to stand, while the others are taken up and replanted. The stock left will attain sufficient growth to produce one bunch of bananas in four months, or three bunches from one plant or 1,200 bunches per acre annually. Planters receive tenpence per bunch at the plantation, and as the cost of production is £10 per acre, very satisfactory profits are realised. A very fine fibre is extracted from the banana stock, which is used in the manufacture of hammocks. —*Journal of the Royal Society of Arts*, Aug. 25.

CAMPHOR PRODUCTION IN BURMA.

The camphor tree, principally the *Blumea balsamifera*, seems to be indigenous to certain parts of Burma, and the experiments conducted by the Forest Department to cultivate the *Cinnamomum camphora* show that this tree can be successfully grown in the Upper Chindwin, Myitkyina, and Bhamo districts, as also at Momeik, while in Maymyo the tree is said to flourish. The experiments of the past few years go to show that it can be successfully grown in Upper Burma, and the species is also expected to do well at suitable elevation in the Shan States. There is, therefore, according to the American Consul-General at Calcutta, a fair possibility of a camphor plantation on a large scale in Burma proving successful and profitable, and there is no reason, it is said, why a

camphor industry should not be started in the province. The question of camphor distillation in Burma was recently considered by the Forest Department. The first point was to design an experimental still of sufficient capacity to see if camphor could be manufactured on a commercial scale from the *Blumea balsamifera*; the next point required a chemical investigation to determine the percentage of essential oil in the fresh green plant, and compare it with the percentage obtained from the plant in its dry state. These analytical determinations were made with the plants growing in the Toungoo and Katha forest divisions, and the results show that the branches and leaves of the *Blumea balsamifera* can be profitably distilled for the extraction of the oil and camphor. In North Hsenwi the leaves and thinner twigs are gathered, though mature leaves are preferred, and placed in a bamboo basket, which is put into a large pot containing water, but not touching the water, and on top of the basket a chatty (vessel) of cold water is placed. Fire is then applied. The steam from the water in the large pot passes through the basked, and the cold water on top, which is frequently changed, acts as a condenser. In a few hours the operation is completed, and on the leaves being removed the camphor is found adhering to the sides of the basket. It is then scraped off and placed in bamboo tubes. The yield varies according to the quality of leaves used in the operation. The camphor finds a ready market locally, as it is largely used as a medicine. The trade is insignificant, as the people extract the camphor only when they have nothing else to do. In Kengtung, on the other hand, a considerablo export trade exists with the southern Shan States.—*Journal of the Royal Society of Arts*, August 25.

TOBACCO, COTTON, AND CASTOR OIL CULTURE IN SOUTH AFRICA.

I have received a copy of the *Journal of the Royal Society of Arts* of March 13th, 1896, containing an article by Mr C Tripp on the cultivation of tobacco in Sumatra, which proves most interesting and instructive, and contains invaluable information.

Unhappily, our Government does not sufficiently encourage farmers to depart from their old-fashioned ways of agriculture, nor is instilled into them the spirit of venture into new methods of farming to move with the times. This by no means implies that the Government must spoon-feed the agricultural community, but it might to advantage impart knowledge by means of lectures and practical proof, and so educate a most conservative people, how to depart from the ways of their forefathers.

A few years since, tobacco culture in the Transvaal and in the Orange Free State appealed to me, and I decided to experiment locally. I gathered advice as to the suitability of certain soil on the Sunday River, and of the climate, and the difficulty of securing skilled labour was eventually overcome. The size of the plants and of the leaves, and the quality of the tobacco, proved highly satisfactory, and the aroma and flavour were excellent.

The following year I extended operations to prove the profits of tobacco culture, with the result that the demand for the local-grown tobacco exceeded far the supply. Many farmers came to view the fields, and a number of them are planting this season, which is encouraging. I am now experimenting with Turkish cigar variety and Brazilian tobaccos. Unfortunately, however, skilled labour is wanting, which is proving a drawback and hardship. Fermentation and the curing of the leaves are imperfectly understood, and our workmen cannot grasp that successful culture lies in such apparently small matters as weeding and in the keeping of the soil loose, topping carefully and systematically, and in the gathering of the leaves separately (and ripe leaves only), and carefully conveying them to the drying sheds,

Cotton Culture.—Last year I planted the following kinds of cotton—Barbadoes, St. Vincent, Egyptian Abbassi, and American Rattler. The plants grew well and the bolls, with a fine fibre lint, were large and well developed. Cotton cultivation should be encouraged, and it is pleasing to find that the East London Chamber of Commerce is taking the matter in hand.

Castor Oil.—On the mines and elsewhere in the Union there is practically an unlimited demand for castor oil. To experiment with the cultivation of the castor bean followed naturally, and I planted the Italian and the colonial kinds. Both grew well and yielded beyond expectations. Under irrigation I feel sure nothing more profitable can be cultivated, but as such lands are limited and largely required for lucerne and cereal cultivation I experimented under conditions approaching those of dry lands with satisfactory results. If dry, the first season might prove trying, but even under adverse conditions, its cultivation will pay from the first year; and as the castor plant or tree is perennial, unless too much exposed the first year or two to frost, I must strenuously advocate its cultivation on dry lands, that is, ground lying idle and useless at present, of which there are millions of acres. I also planted a variety which attains a height of upwards of ten feet with wide-spreading branches, strong enough to support a man's weight. It is, therefore, not difficult to grasp the rich harvest obtainable therefrom. Still our farmers shrug their shoulders and smile when urged to grow the castor bean. Yet ere very many more years have passed the castor bean, like lucerne, against which farmers exhibited bitter dislike, will grow extensively, and prove a profitable branch of South African agriculture.

P. J. Fourie.

Jansenville, August 5th, 1911.

—*Jourant of the Royal Society of Arts*, Aug. 25.

TEA: HIGH PRICES.

It is satisfactory to see an average of 1s a lb. in Mincing Lane for Ceylon tea and "Diyanilakelle" has to be congratulated; but what is that compared to an average of 2s 10d paid for "Jungpana" teas—we suppose from Darjeeling—in the latest London sales. Calcutta exchanges contain accounts of the sale of two choice lots of Indian tea in Mincing Lane at the mid-September Auction, both being secured by Messrs. Harrisons and Crosfield. The first bid was 4s a pound in Bond, the final price reached 5s 11d ex duty. The second lot was 5s 3d duty paid.

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RUBBER PROSPECTS.

(*Lockwood's London Letter*, Sept. 16)

After a little set-back, the effect of which was emphasised by some profit taking on top of the recent rise. the Rubber share market appears definitely to have settled down to a more hopeful frame of mind. Transactions in this section, though still modest in volume, are more important than the recorded price-changes would appear to indicate, and dealers report that there is a constant stream of quiet investment business on account of shrewd people who recognise the strong technical position of the commodity and are convinced that another general forward movement of prices cannot much longer be delayed. So far, the buying that has been in progress has been confined mainly to the leading issues.

Sept. 20th.—Without the Rubber Share Market the Stock Exchange would indeed be in the dumps. While foreign scares and home strikes have badly affected values in all other directions, the rubber share market has been steady to good, and one does not look in vain for favourable factors which are responsible for this condition. A feature of the past week has been the large number of small buying orders from the provinces and elsewhere—orders devoted, for the most part, to high-class shares of the type that will be entering the tanks of the big producers during the next twelve months or two years. Evidently, investors are beginning to realize that there is a permanence, after all, about the Rubber Plantation Industry. The older producing companies continue to pay out satisfactory dividends with a comforting persistence, and the younger companies show signs of emulating their elders in the very near future. The Linggi Company has declared its second interim dividend of 43¾ per cent, and the Selangor Company announces a distribution of a second 62½ per cent; while the growing outputs from the younger plantation companies justify expectations of early initial distributions from them.—*Zorn and Leigh Hunt.*

"INTENSIVE GARDENING."

October 7th.

SIR,—Who can tell us exactly what "intensive" gardening means—especially as applied to the tropics? There is a good deal of talk about it in England, not so much cultivating under glass; but in the new French mode—whatever that means? The word "intensive" does not once appear in the index to Macmillan's "Handbook of Tropical Gardening and Planting."—Yours, &c.,

ECONOMICAL HOUSEKEEPER.

Oct. 13th.

SIR,—In "Intensive" gardening, plants are grown under glasses, a bell-shaped glass over each plant. Rows of them can be seen in gardens where this method is used. I send this as I saw the question asked by a correspondent in your paper.

LETTUCE.

LATEX AND ITS RELATION TO THE LIFE OF THE PARENT PLANT.

There are present in many plants chemical substances which, although recognised as products of activity of the living cell, neither in their exact mode of formation nor in their full significance are clearly understood. Among such substances are the alkaloids, glucosides, colouring matters, ethereal oils, resins and caoutchouc or india rubber. Many of these products are of some considerable economic importance. The alkaloids include strychnine, quinine, morphine and other drugs and violent poisons. Of the glucosides, which are compounds of sugars with various substances, some too are poisonous, yielding on decomposition prussic acid. The Lima bean or Java bean contains such a glucoside; and when it is growing wild the percentage of prussic acid in the stems and leaves may be sufficiently high to be fatal to animals which feed on it. There is good reason to believe that such a glucoside occurs in the shoots of the Para rubber; and an example of its poisonous properties occurred several years ago, when some Para rubber trees growing in the garden of the Residency in Taiping were felled because they had proved poisonous to horses.

The presence of such poisonous substances in plants serves no doubt to check the ravages of animals; but this can scarcely be regarded as a primary function.

The colouring matters in plants serve to attract insects, whose association with plants is frequently beneficial.

The ethereal oils and resigns are recognised as products of excretion. But the significance of the relation of these bodies to the economy of the parent is not clear.

The significance of the presence of caoutchouc in plants is, perhaps, still less clearly understood. Caoutchouc occurs in the latex of plants of different natural orders, among which are the *Euphorbiaceæ*, including *Manihot*, Ceara, and *Hevea*, Para rubber, the *Urticaceæ*, containing *Ficus*, Rambong, and *Castilloa*, and the *Apocynaceæ* of which *Willughbeia* and *Leuconotis*, Borneo rubbers, are members, along with the various natural orders which contain numerous species yielding so-called "gutta-percha." Latex is the name given to a fluid which is either watery or viscous, colourless, white, yellow, orange or red, and is contained in specialised cells, called latex tubes. The cow tree of Venezuela (*Galactodendron utile*) yields a sweet milk of good flavour; the dried latex of the Poppy (*Papaver somniferum*) is the opium of commerce; the milky Agarics, fungi of the mushrooms type, yield white, orange or red latex; and many other species occur which are of interest or of economic importance.

Latex is an emulsion of various substances in a water-basis; these are resins, caoutchouc of different kinds, oils, tannins, proteids, sugars, starch, alkaloids, ferments and salts. The tubes in which the latex occurs are divided into two classes according to their mode of origin, viz.—laticiferous vessels and laticiferous cells; the former arise by the fusion of independent cells, this class including *Manihot* and *Hevea*, while the latter originate by the growth of special cells which are said by some to be differentiated in the undeveloped embryo of the seed. These tubes, when fully formed, are living cells connected by branches and frequently forming a close network; they occur in all parts of the plant.

The tubes, when present, are associated in the stems and leaves of plants with those special tissues to which the function of conducting plastic food-material is ascribed. And this close association, coupled with the richness of the latex in food substances, such as proteid, starch and sugar, suggests at once that the latex tubes function as a conducting system by means of which food material is conveyed from one part of the plant to another. There is other evidence in support of this suggestion. For example, where latex tubes occur, those particular tissues which are normally concerned with the conduction of so-called elaborated food-material are deficient and are frequently badly developed. Again, in *Euphorbia*, as the young plant commences to develop in the seed the latex becomes poorer; when it has germinated the latex grows richer. And abnormal conditions which stop certain of the life-processes, notably that of *assimilation*, make the latex poor.

Assuming, then, that the tubes serve to conduct food-material in the plant, the question arises "Is the latex actually in circulation in the plant?" That it is so there is no doubt, since Schwendener has actually seen it in transparent seedlings of *Chelidonium*.

From this evidence we conclude that latex bears some actual relation to the economy of the parent, and this relation must be the conduction of plastic food-material. When, by some interference with the normal life-processes of the plant, the latex becomes poor, on the resumption of the normal condition it becomes again rich, and the richness in food material has been found to commence in the leaves and to extend to the roots. We can have no stronger corroborative evidence than this of the supposition that the latex tubes are a path by which food-material is conveyed in the plant. We, therefore, conclude in the light of modern conceptions of the nutrition of plants that the laticiferous system in plants serves the purpose of conducting plastic food material.

In addition, however, to containing food substances the latex contains bodies which are regarded as "excretory substances." The plant has no means by which it can excrete its useless products outwardly; and the excretory substances are stored in different parts of the plant body. Such substances are regarded as "end-products" in the metabolism of the cell and are incapable of being utilised for purposes of nutrition. The resins, gum-resins and gum-mucilages are recognised as excretory products. Such substances are known to occur in latex; the latex tubes are, therefore, regarded as serving the function of excretion. The caou-

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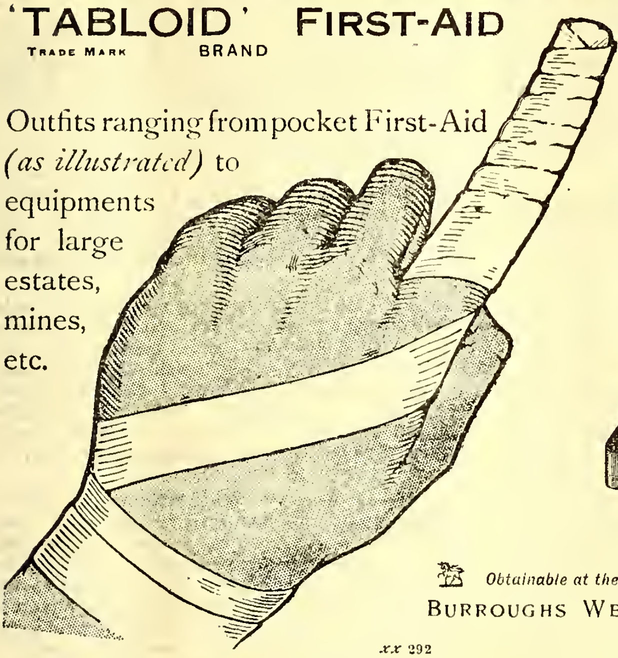

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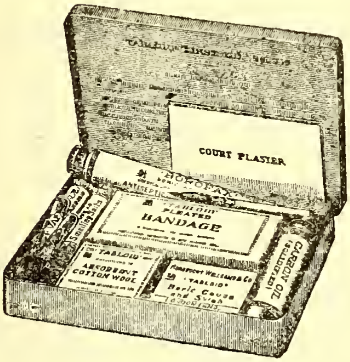

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tchouc in all probability does not exist as such in the latex, but is produced during coagulation from simpler bodies similarly constituted chemically. It is itself a compound of carbon and hydrogen and is chemically comparatively inactive. There is, therefore, some probability that it is an end-product and incapable of being further utilised by the parent. Much more requires to be learnt, however, concerning the changes which occur in latex in different parts of the plant and under different conditions, before any accurate conclusions can be arrived at as to the significance of the presence of caoutchouc.

Enzymes have been demonstrated in the latex of some plants. *Ficus carica* and *carica papaya* (papaw) contain peptonising enzymes. The presence of an oxidase has been demonstrated in the latex of *Hevea*; the occurrence of black latex is ascribed to this enzyme. The presence of enzymes is significant of the occurrence of active changes in the latex.

In addition to the abovementioned functions of latex two others occur, viz.—the sealing of wounds and the protection of the plants from animals. Latex containing caoutchouc coagulates quickly, and the coagulated mass serves to seal wounds more or less effectively. In some plants the latex tubes branch close to the surface and thus facilitate the sealing of wounds by the juice. In other plants hairs containing latex are present on the floral bracts and are thus regarded as serving to protect the flowers from animals; while the occurrence of poisonous substances in latex is no doubt an efficient means of protection against certain animals. It is not uncommon to find insects in the neighbourhood of *Hevea* plantations bearing masses of coagulated latex on all parts of their bodies in such quantity as to considerably hinder their movement; and it is believed that the insect pests of *Hevea* would cause considerably greater damage, were it not for the protection offered by the latex.

The occurrence of these two functions of latex is clear; but, they are in all probability not primary functions and can only be regarded as incidental. With regard to the two first named functions, the one of conducting food-material and the other of receiving products of excretion, it is uncertain as to which was the primary one.

The relation of latex to the life of the parent possesses for more than mere scientific interest. The recognition of the laticiferous tubes as a means of conducting plastic food material is of itself of primary importance, inasmuch as such problems of practical importance as tapping, systems of tapping, bark renewal, etc., are closely connected with it, while an accurate knowledge of the significance and mode of formation of caoutchouc must be of considerable value to the practical cultivator.

KEITH BANCROFT, B.A.

—*Straits Agricultural Bulletin* for Sept., 1911.

A NEW CAFFEIN-FREE COFFEE.

In this Process Germination of the Bean Takes Place and the Caffein is Extracted Without the Use of Chemicals.

A new caffein-free coffee is being introduced to the trade by the Hübner Health Coffee Company, 65 Front street, New York. This product is covered by a patent, dated January 25, 1910, issued to Robert Hübner, and, according to the manufacturer, is the result of over forty years spent in the study of coffee.

The natural process of germination is used in extracting the caftein and no chemicals are applied. It is said between 80 and 90 per cent of the caffein is extracted in this way. The small percentage remaining is not soluble.

Statement by the Inventor.

Dr. Robert Hübner has prepared for us the following statement concerning this new caffein-free coffee :

"The extraction of the caffein takes place simply by the action of water on the coffee bean, without employing benzol, alcohol, chloroform, carbon disulphid, acetic ether or any other chemical.

"By the action of the water on the coffee beans not only the caffein is extracted but also the surplus of the acids as well as aldehydes and other substances which form in roasting tho furfur alcohol.

"A decoction of this coffee can be used by persons who are not able to drink untreated coffee. Such persons have been known to sleep soundly after it.

"The lowered percentage of furfur alcohol is a further advantage possessed by this coffee. Furfur alcohol is just as detrimental to health as caffein, and both in conjunction are even stronger in action by supporting the effectiveness of each other. The extremely low percentage of caffein as well as the low percentage of furfur alcohol in this coffee precludes the possibility of its use causing any nervous trouble or disturbance. There are many people who might be able to withstand the action of caffein in coffee, but they cannot drink untreated coffee because, as they say, it causes sour stomach or heartburn. This health coffee, with no surplus of acids, becauso they are largely romoved in the extraction process, will not cause any such disagreeable sensations."

The Patent Claims.

According to the patent papers the method of extracting the caffein in the Hübner process is as follows :

"The raw coffee beans are distributed over the surface of a shallow dish or pan and covered with water having a temperature of approximately 15 degrees centigrade. There should be sufficient water to cover the beans and maintain them covered during the time they are immersed and absorbing water. The beans should remain immersed until they have doubled in size, or otherwise have absorbed all the water which they will take up. The time of immersion will therefore vary between twelve and twenty-four hours, depending upon the quality, condition of ripeness and age of the bean. If the beans are old or dirty, or mixed with other substances, it may be necessary to change the water a number of times. After the beans have swollen to double their size and the water or waters used in the preliminary treatment above described removed, they are again immersed in water under the same conditions and at the same temperature, and allowed to remain immersed until partial germination has been accomplished, or, in other words, until, by chemical tests, the presence of maltose can be detected."

The patent specifications say that the elementary principle evolved in the process consists in primarily affecting a limited germination of the coffee bean, which acts to break down the normal union of the combined materials in the bean so that they may be extracted by water.

As soon as the presence of maltose is detected the beans are washed with water at a temperature of from 50 to 60 degrees centigrade, which stops germination. The washing is continued until the gum-like coating of the beans (caffetannic acid) and most of the remaining caffein is washed away. The beans are then dried in thin layers on pans by passing a current of hot air over them.

From the watery solution obtained in the treatment of the beans caffetanic acid, caffeic acid, salts, etc., are precipitated by the addition of some basic material, such as sodium, potassium or calcium. "The watery extract, from which the precipitated matters have been removed, is then concentrated and the caffein separated therefrom by the employment of chloroform or other readily volatizable substance, and subsequently the chloroform or other volatizable substance removed by subjecting it to the action of a jet of steam. The removed precipitated matters, *i.e.*, the caffetannic acid, caffeic acid, organic coloring matter, salts, etc., may be again made into a solution with water and, if desired, re-embodied in the coffee beans by any suitable process, after which the beans are again dried."

The specifications claim a new process of removing caffein from green c ffee beans by osmotic action ; also as a new article of manufacture, green coffee beans having their cellular structure altered by limited germination (partially converted into maltose), and from which the major portion of the normally contained caffein has been removed.—*Tea & Coffee Trade Journal,* for September, 1911.

TOMATO-SEED OIL.

The manufacture of an oil from tomato seed is an industry of quite recent date in Italy, where the growing and preserving of tomatoes is carried on extensively in many parts of the country. In the province of Parma alone, upwards of 84,000 tons of this fruit are packed every season. The utilisation of the seed, which forms so large a percentage of the waste in the process of packing, and which was formerly thrown away, must now add considerably to the profits of the packer. This oil somewhat resembles that of cotton seed in its properties, and it is beginning to be in steady demand for soap-making.—*Royal Society of Arts Journal,* August 25.

PARA RUBBER IN BURMA.

ITS PROGRESS.

Since the introduction of Para rubber into Burma, some fifteen or twenty years ago, the cultivation has extended from Mergui, in the south, to Bhamo and Myitkyina in the extreme north, and today there are several thousand acres under cultivation, and the area is rapidly increasing, labour being cheap. In Bhamo, Mr Kohu has a small plantation, the trees being about fifteen years old, Here the results have been most favourable; so much so, that last year the rubber from this plantation, because of its texture and quality, brought 1s. 3d. more per pound than was paid for any other Plantation rubber placed upon the London market during the season. The seeds, too, from this plantation, of which about 90 per cent. germinate, produce strong, healthy plants, equal, if not superior, to those obtained from Ceylon seed, the latter very often producing twisted plants which is in no way due to the position in which the seeds are planted. In the Myitkynia District, Mr K Young has 2,400 acres, of which up to date it has only been possible to plant 500 acres, but the trees, some of which are now nearly three years old, are all doing well. About six years ago, in Myitkyina town, some trees were planted as an experiment in the Forest compound. This year, these trees were tapped, and though the method of tapping was most primitive, the results obtained were excellent both as to quality and quantity. Further south in Tounghoo, Shwegyin and the vicinity of Rangoon and Amherst there are large plantations all of which are doing well, thereby going to prove that the whole of Burma (with perhaps the exception of the dry zone round about Pokokhu, Myingyan, Sagaing, Shwebo, etc.) is pre-eminently suitable for the cultivation of Para. As a matter of fact, even in the dry zone the soil compares very favourably with that in some parts of Ceylon which produces rubber.

The Government of Burma are only too willing to help *bona fide* planters. Such may have for the asking, in any District which has been declared by the Government as a rubber producing tract, 1,200 acres exempt from taxation for a period of from eight to twelve years, on a leasehold for thirty years, with the option of renewal for another twenty years. At the end of the eight or twelve year period, as the case may be, the land is taxed at the paddy rate assessment, which in no case exceeds Rs. 1·8 per acre. It is true that in consequence of large Companies being formed for the purpose of rubber cultivation, Government have in view the revision of the foregoing concessions, but the revision will only be nominal, after all, and will only affect certain Districts. The soil of Burma is as rich as any in the world, being a sandy loam in some parts and a volcanic ash in others The mountain ranges trend in such a direction that the South West Monsoon sweeps right up the valleys without hindrance, thereby ensuring an equal distribution of moisture. Thus, from a climatic point of view there is little to be desired. So far, the only pests which have attacked rubber have been white ants, male crickets, pig, deer, and sambhur, which latter are a nuisance in the north. The two first mentioned are easily got rid of by using kerosene oil emulsion of sulphuric acid, the method being to inject it into their nests or holes. As for the game pest, after barbed wire fencing, a man with a gun is very effective, besides it keeps the pot boiling, a thing much to be desired in a land where markets are few and far between.—*M. Mail,* Oct. 12

NEW RUBBER DRYING METHODS.

PARADISE FACTORY AT KAJANG DESCRIBED.

According to the latest issue of "Grenier's Rubber News" the Paradise estate at Kajang, Selangor, has erected a factory in which the drying of rubber will probably mark a new era in the local manufacture of rubber. The factory is a substantial two-storeyed building of brickwork, with an iron roof. When it became necessary to build a factory on the above-named estate Mr. E. V. Carey, with characteristic up-to-dateness, decided to adopt a method of drying rubber by hot air forced through the rubber by mechanical power, the obvious advantage of this method being that the rubber will be dried probably in a tenth of the time taken by the ordinary methods. If the Paradise method proves success as far as the quality of the dried rubber is concerned it will be obvious from the financial point of view that the departure will come as a boon.

The main plan of the Paradise factory comprises a washing and drying house, 70 feet by 35 feet, packing room 24 feet by 35 feet and an engine room 50 feet by 21 feet—all on the ground floor. The upper floor holds three airtight cubicles, each of these measuring 50 feet by 12 feet, for the drying of crepe. On one side of the washing and drying house on the ground floor are four of Shaw's washing machines, and on the other are six patent rubber driers, each chamber of which contains 24 trays, on which the rubber is placed, hot air being forced through from a furnace outside the building by fans. There is also a large furnace serving to distribute hot air into the cubicles on the upper floor by means of pipes, which are carried on that floor to the cubicles and which are perforated at certain intervals so as to distribute the air as evenly as possible. The method adopted on the ground floor of drying by chambers has already been tried with great success in Ceylon for drying rubber.

The method of drying in cubicles adopted on the upper floor of the Paradise factory has already been tried with great success for the drying of cocoa in Ceylon, but has not been previously tried for rubber. If the combined systems, chambers and cubicles as introduced on Paradise, prove a success it is estimated that as much as 1,000 lb of rubber could be dried in a day of ten hours. It remains to be proved what particular form of rubber will lend itself to this method of drying.

RUBBER IN JAVA.

There is published in "Grenier's Rubber News" of July 8, an interview with Mr. G. A. Wilmot, manager of Kalimenger Estate, Djerockeigi, Java, who was on a visit to the F. M. S. Mr. Wilmot thinks the somewhat backward growth of a great deal of Java rubber is due to the fact that of the 60,000 acres under rubber in Java, a large majority of the estates are interplanted with coffee. He, however, thought that where the rubber was grown by itself it showed as favourable a growth as obtaining in other parts of the Middle East, and he anticipated that the Bandjar district, where a number of rubber estates are coming on well, should ere long make a reputation for itself. Mr. Wilmot referred to the practice in Java of having honeycombed terraces and waterholing on the slopes, and of deep draining, owing to many of the estates being on the edge of morasses, on the flat. He also stated that on the slopes they dig a small trench about 6 ft. in front of a line of rubber trees. The put into this trench the seeds of the Kemalndinan legume. As these grow up they prevent wash from the terraces, while the nitrogen they contain contributes to the nutriment of the trees.

MOSQUITOES.

"The Reduction of Domestic Mosquitoes:' By E. H. Ross, Murray, 5s, deals primarily with the removal of the causes of tropical disease, Mr. E. H. Ross, the pioneer exponent (in Egypt) of his brother's great discovery, is one of the authorities of note. Mr. Ross's book is, as it were, an admirable enlargement of the Mosquito Brigade Handbook published some years ago by his brother. It is much bigger than that little book, and no less practical; it is throughout beautiful with a vehement enthusiasm which one has come to associate with the name of Ross; and, better still, it brings the subject home by a most interesting study of the life of a female mosquito. It tells not only what the mosquito is and does, and how it lives, but also how it may be checked. how attacked, and what the cost will be, and what the opposition, and the results in terms of human prosperity.

A book like this book of Mr. Ross's should be issued broadcast to every official in all our tropical dependencies; for though the glory of the discovery of the part played by the mosquito in the spreading of disease is due to Englishmen, our application of the discovery to life has been done, on the whole, in a niggardly, stupid, pig-headed, narrow, unenlightened way. When it has been well done, it has been, as a rule, more by private enterprise—the enterprise of men like Mr. Ross—than by an enlightened intelligence in our State officials.

A Deadly Disease.

The national slowness has its merits and its uses, but national apathy is a deadly disease. During all those ten years of "thought" human beings have died in India of mosquito-borne disease at the rate of about two a minute. Five or six a second would perhaps not be an excessive estimate for the number of those infected by mosquitoes during that time. The 'consideration" of those responsible may well be serious; even a Napoleon has fewer ghosts to haunt him. Mr. Ross does not ask for a despotism to bother people who only want, as the phrase goes, "to be let alone." He pleads for an intelligent administration interested in human health. He has had experience of an administration so little interested in public health that, as he says, "we" (the mosquito destroyers) "were forced to employ every ingenuity to gain our object," the object often being the suppression of burst cesspools in people's cellars, and the filling up of open stinking cesspools owned by the Government. Still as he says, the difficulties can be surmounted, and "popular administration does more for the community than despotism."

THE RUBBER EXHIBITION AND AFTER.

(By James Ryan.)

"Of rubber young and rubber old,
"Of rubber hot and rubber cold,
"Of rubber tender, rubber touch,
"Praised be the Lord! we've had enough!"

Old Grace (slightly altered.)

Now that the Exhibition at Islington is over it is perhaps possible to co-ordinate a few ideas out of the chaos of mixed impressions that so colossal a show tended to produce in one's mind.

Thirty-three (or was it 34?) countries or Governments made the bravest show of their best and innumerable manufactures, not only of rubber goods but of machinery and allied articles, which filled a wilderness of space with kaleidescopic samples, wonderful photographs, weird slices of savagery whirring machinery and complicated cutlery.

Plantation Rubber.

Out of it all Ceylon and Malaya came out with the honours of war. Their exhibits lacked the picturesque savagery and the artistic setting of the Congo pavilion and the Brennus-like tonnage that Brazil dumped into the scale, but they were put in a neat setting and showed the commercial superiority of British plantation-grown rubber in a marked way, while any visitor in search of information was "coached" on the spot by experts such as Mr Bamber, Dr. Petch, Messrs. Baines, Golledge, Ingleby, &c., who spent hours daily in what was at times (with the thermometer trembling on the verge of the nineties) anything but a light task. They often had, too, to "suffer fools gladly" with but rare interludes of compensating humour, as in the case of one gentleman, who, at the conclusion of a half-hour's demonstration of "Hevea from the V cut to the Venesta," wanted to know: "Have you ever any difficulty in *coagglutinating* your latex?"

From the Congo, perhaps, we might pick up one tip for the future, and that is to copy the beautiful little series of cut-out scenes representing:—

1. The Virgin Judge
2. The New Clearing
3. The year-old planting and Kajan Bungalow
4. Rubber in Tap.

Theso might easily be reproduced in the Colombo Museum or, better still, in the Arcade or one of the Colombo hotels.

RUBBER PAVEMENT.

Much interest was shown in the exhibits of Rubber Pavement, but it must be stated frankly that we are a long way off seeing this in general use even were rubber to go to 2s 6d per lb. As far as the unbiassed critic can judge it is hopeless, when wet, as far as horso traffic is concerned and not at all easy to steer a motor over under the same conditions without considerable danger of side slip. In any place also where oil or petrol is likely to be split rubber pavement is clearly impossible. Under cover, however, and in such places as Railway waiting-rooms, vestibules and passages where people coming in from without with muddy boats and where luggage is noisily dumped, a rubber pavement is *the* ideal flooring. It has been in use for some time at the North British Station Hotel, Union Street, Glasgow, and is there an established success.

It should not be beyond the resources of the Ceylon Government to lay a small experimental patch at the Colombo jetty, at Maradana station, and at Nanuoya. I am quite sure that manufacturers would be only too willing to co-operate by placing their goods on view at the narrowest margin of profit—where the ultimate advertisement would be so directly to their advantage.

Failing Government initiative (and in these cases the attitude of the Ceylon Government has been compared aptly to that of the Griffin on the west front of Amiens Cathedral which stoppeth up one ear with its tail, while it buries the other in the mud) the Planters' Association might take at least the *pour parlers* in hand.

SYNTHETIC RUBBER.

So far as practical demonstration is concerned this remains exactly as it was two—nay—ten years ago. There was on show a row of bottles of volatile, translucent, evil-smelling fluids of a benziney, turpentiney type, a half-dozen or so of photographic developing dishes with what looked like American chewing gums in various stages of mastication, some 2½ ounces of inferior-looking rubber which speedily gave way under the perpetual pulling about, and that was all! Statements were made that the rubber could be made for 6d to 8d per lb. from starch, sugar or sawdust, but there was not one tittle of evidence to go before a jury beyond the mere *ipse dixit* of the puppet who was in charge of the stall. A practical demonstration was given which produced, in the course of some 3 or 4 days, about a couple of pounds of the inferior rubber alluded to, but I have heard of no valuation of the resulting product, either raw or vulcanised. No! as far as synthetic rubber is concerned the Ceylon Rubber Planter can go to sleep for a year or two yet without risk of his slumber being disturbed by the synthetic nightmare. It must also be remembered that it would take many years of cautious practical experimenting before a manufacturer would daro to apply this new product to any major work, such as a deep-sea cable or a largo generating plant. The slightest rise in price of turpentine, the fall of real rubber to 2s 6d per lb., heavy capital expenditure on machinery, danger from fire in the producing factory —factors of this kind are all dead against that alnaschar-like visions of the logroller of synthetic rubber.

VULCANISATION OF RUBBER ON THE ESTATE.

There are, however, not wanting signs that at some not distant date something may be done to vulcanise rubber before shipment from Ceylon and Malaya. The process is so excessively simple, and it so effectively prevents the daily alteration in quality and appearance of unvulcanised rubber of all grades (except block or very thick sheet) which now occurs, that it only requires a steady and continuous effort on the other side of the water to ensure a steady London demand. Out and out the best sample of rubber in the show was a vulcanised pieco of thin sheet from Gikiyanakande. This was vulcanised in England, but it remained unaltered throughout the three weeks it was on show while unvulcanised estate samples were altering from day to-day under the influence of heat, light, oxygenation and enzymes. Even in the case of Block rubber *strive* of discolouration would appear, showing molecular changes even in the heart of the component sheets of the block.

A PRACTICAL PROOF.

When I was in Bombay a couple of years ago a steamship owner told me that he had had some honeycomb rubber mats and staircase flutings made from estate rubber vulcanised in Singapore, and that the articles produced were no dearer than, and lasted three times as long as, the British-made article. However much such a statement may need to be discounted, it opens up a vista of possibility which would justify as much expenditure as we Ceylon Planters spend on pushing Ceylon tea in America and elsewhere.

PACKAGES.

In the matter of packages it was a case of "Eclipse first and the rest nowhere" as there was nothing to compete with the "Venesta" packages. The perfectly smooth interior of the birchwood veneer adapts them specially for use for packing rubber. I presume that by this time all Rubber planters are aware that it is the *inside* of the rubber package that requires the most careful planing as any splinters or roughtags become incorporated with the surface of the rubber, are exceedingly difficult to remove and (if present) may cause a considerable loss in price. All this is obviated by the "Venesta." In the case of tea where freights are low many planters have failed to find that the saving in freight on Venestas pays for the extra cost over the 'Momi' or the country package, but where (as in an account sale before me while I write) freight from Port Swettenham amounts to 75s per ton, and the Port rate, &c., to 37s 6d, a saving of 10 per cent on 112s 6d per shipping ton is a factor not to be neglected. There are still complaints that the "Venestas" are difficult to cooper up again when once opened, but in the case of rubber this is obviously of far less importance than with tea. There is, perhaps, more validity in the complaint that the batten round the inside rim of the "Venesta" makes it difficult to turn out

the contents. Rubber has a curious knack of shrinking *en voyage* and moulds itself surprisingly to fit any ledge or projection in the package.

Tackiness.

The *enzyme* of tackiness appears to flourish in the air space left by the shrinkage of rubber in the package. It might be worth while (where this is known to occur frequently) to paint the inside of the package with a 10 per cent. solution of formaline. Personally I should be tempted to spray all crepe especially with a solution of formaline not less than 2 per cent and not more than 5 per cent., but the manufacturers are so suspicious of any innovation that such a course is at present out of the question.

Chemistry.

Very little progress has recently been made in this department. The various committees appointed at the Exhibition of 1909 frankly reported that they had no completed results to lay before the Conference. One of the manufacturers, who was mainly interested in the electrical applications of rubber, said that he objected to the presence of acetic acid in rubber as this made it useless for his purpose. It was pointed out that it was impossible by even prolonged washing to remove all acetates as they were incorporated with the albuminates in the latex and were insoluble. It afterwards became evident, however, that the objection was to FREE acid in the interstices of crepe, or even more so to "block" made from crepe containing free acetic acid.

It is therefore

VERY IMPORTANT TO THE PLANTER

that all *free acid should be washed out of the rubber* at as early a stage as possible. Free acid can be easily detected in an instant by the use of

BLUE LITMUS PAPER

a chemical of trivial cost.

Pure Water on Estates.

It is increasingly evident that very great importance should be paid to the water supply of the rubber factory. In wet weather especially every trace of sand or matter in suspension should be removed. A case in which purity of water supply directed expert attention to the sample was that of Nikakotuwa estate, which from this cause was of stand-out quality.

Dust.

This should be avoided as much as possible especially in the coagulating room, which should be kept as clean as the best managed dairy. Wire blinds should cover the windows.

Effects of Lights on Rubber.

There is an increasing balance of evidence to show that coagulation is more satisfactory in the dark or in a very dim light. External Venetian jalousies would effect this manipulated from within.

Coolness while Coagulating.

Except in the case of coagulating by steam or smoke it appears that coagulating is most successful in a cool temperature. 60 degrees Fahrenheit is, perhaps, ideal, but this is rarely possible without ice in the low-country. By the use of fans and wetted tats, however, a certain measure of coolness is always obtainable.

Drying Rooms and Vacuum Driers.

A large number of the biggest producers of rubber, especially in Malaya appear to be prejudiced against the use of Vacuum Driers. Be this as it may, there appears to be little doubt that the best rubber is produced at a temperature of 150 degrees Fahrenheit in a free current of air at the normal atmospheric pressure. It is difficult to see how the vaccuum could have any injurious effect, but perhaps it is that errors of manipulation are difficult to detect in in driers used when the superintendent is not actually present.

Chemical Tests for Rubber.

The brokers appear to value rubber entirely by the old rule of thumb methods with which we were made familiar at Peradeniya in 1906. The great drawback to testing raw rubber even chemically seems to be that two samples of rubber (giving identical results when tested chemically and by the usual tests for breaking strain, resilience, &c.) behave quite differently when vulcanised.

Resin, for example, is looked on askance by many buyers, but actual tests have proved that rubber containing 8 per cent. of resin has in certain cases given tip-top results from the manufacturers' point of view. The finest hard para often contains quite high percentages of resin compared with ordinary plantation.

Over-rolling.

There appears occasionally (not as a rule, however) to be a certain amount of injury done to rubber by overworking on the rollers. This is perhaps, most marked in scrap from bark (even live bark, not dead and cankered stuff.) On the other hand, there is the paradox that dead recovered rubber which has completely lost its elasticity is often magically revived by rolling.

Summary.

I hope that these remarks may prove of some value to those practical planters in Ceylon who were unable to attend the Rubber Exhibition, I think I have said enough to show that an enormous field remains open for investigation. To sum up, I should think—(1) an ample supply of clean water, (2) a cool, dark coagulating room, and (3) a quick *cure* are the three great *desiderata* of rubber manufacture.

—"*Times of Ceylon.*" J. R.

TEA IN THE CAUCASUS.

The heavy snow fall of the past winter in the immediate vicinity of Batoum, combined with the unusually cold weather experienced in December, January and February last, did much injury to tea plantations. A large number of the older tea shrubs had their branches broken off by the weight of snow, and the young plants suffered much from cold. The yield of the 1911 crop is estimated at about 200,000 lb., or about 50,000 lb. less than in 1910. The area under tea in the neighbourhood of Batoum is slowly but steadily being extended. A tendency of small farmers to embark in the enterprise is apparent.
—*Board of Trade Journal*, Sept. 28.